

13822
32

PHYSICAL ATLAS

WITH

COLOURED MAPS,

SHOWING

THE GEOGRAPHICAL DISTRIBUTION OF PLANTS YIELDING FOOD;
CLIMATES ; FLORA ; SOILS ; REGIONS OF SUMMER RAINS ;
GEOLOGICAL FORMATIONS AND HYDROGRAPHY

OF THE

DOMINION OF CANADA.

By J. BEAUFORT HURLBERT, M.A., LL.D.,

*Corresponding Member of the R. H. S., London; Author of "Britain and Her Colonies," "Field and Factory,"
"Climates of Canada," &c.*

G1116
C1
H8
fal

252930

Entered according to Act of the Parliament of Canada, in the year 1880,
by J. BEAUFORT HURLBERT, M.A., LL.D., in the Office of the
Minister of Agriculture.

THE rights of translation and reproduction are reserved.

PREFACE.

THE RIGHT HON. W. E. GLADSTONE, in a late number of the *Nineteenth Century*, called Canada "Those huge ice-bound deserts of North America." The chief geographies of the United States, formerly used in the public schools of Canada, describe the entire continent west and north-west of Lake Superior as,

"Like Greenland, a cold, barren country, thinly inhabited by Esquimaux and other savages, and the soil so rocky and thin that only moss, shrubs and a few stunted trees can be grown upon it." This description is accompanied with cartoons of Esquimaux in snow-huts defending themselves with bone spears against huge bears, or standing on polar ice attacking walruses and seals.

One map, published by American immigration agents, cuts off 20 degrees of the best part of the North-west, representing it as part of the Pacific Ocean.

In *Johnson's Universal Cyclopaedia* (4 vols., 7,000 pp., New York, 1879,) edited by Frederick A. P. Barnard, S.T.D., LL.D., L.H.D., M.N.A.S., president of Columbia College and thirty-five other A.M.'s, LL.D.s, &c., four presidents of colleges, "ex-presidents" and Prof. Henry, secretary of the Smithsonian Institute, it is stated that "The northern portion of the Dominion will undoubtedly be doomed to eternal (?) sterility on account of the severity of the climate." To show what is meant by the northern portion of the Dominion the cyclopedists say in the next sentence, "The country on the lower Saskatchewan and on the Red River, it is believed, will be long among the most fertile regions of the Dominion." The best part of that country is north of the lower Saskatchewan and up to 700 miles north of it.

James Croll, of the Geological Survey of Scotland, in his *Climate and Time* (London 1875), says: "The July temperature of Glasgow is 61°, while in Labrador on the same latitude and places to the west [how far west?] it is only 49°. Glasgow, during that month is 3° above the normal temperature, while America [how much of America?] is 9° below." (p. 72.) The most western locality given by Croll is Cumberland House (lat. 54° 30', long. 103°.) Croll leaves the impression that the climates of the entire north-west in the latitudes named are like Labrador.

The Globe Encyclopedia, by J. M. Ross, LL.D., senior master of English language and literature, High School, Edinburgh (6 vols. Ed. 1876) contains half a dozen statements under the article Canada, all of which are wholly untrue or gross misrepresentations.

"Among the chief obstacles" says the Encyclopedist "of the agriculturist, are the periodical plagues of grass-hoppers and mosquitoes, the length of the winter, the want of means of communication, the presence of ague-breeding-swamps, and the inundation of rivers on the melting of the snow. The

great forests of New Brunswick, Quebec, Ontario and parts of Manitoba consist mainly of red and white pine."

The highly civilized nations around the shores of the Mediterranean, in the early history of the Roman Empire, regarded Gaul, Germany and Britain as fit only for barbarians. The opinions of some of the best read men of the age, given above, and uncorrected by their authors, of one half the North American continent, are similar to those entertained 2,000 years ago of all the northern and north-western countries of Europe.

To correct these and similar errors is the object of the maps and letter press of this work. They show that the climates and productions of the Dominion are similar to those of the western central and north-western parts of Europe.

The maps are designed to illustrate the physical features of Canada; to give the zones of the chief food-plants; the forests and prairies; the hydrography; the geological formations; the summer isothermals of the Dominion. &c.

By permission of the minister of the Interior, the Right Hon. Sir John Macdonald, the author has had the valuable assistance of J. Johnson, chief draftsman of the Department, in the preparation and printing of the maps.

In addition to the information which the early explorers and officers of the Hudson Bay Company have given us of the north-western territories of Canada, we have now the full and definite reports of the Railway, Geological and Surveyor General's Offices.

To these the author has made constant reference in drawing the maps and writing the letter press. These notes have been made as brief as possible.

In referring to the maps of the zones of the various plants, the usual allowance must, of course, be made for rough mountainous districts, and for damp and poor soils. These are found in all countries and are local and exceptional.

That many errors will be found in the work as the country becomes better known, none can be more convinced than the author. The subject is new, the country vast, and much of it imperfectly explored. But to point out error is one means to the discovery of truth.

The phrase "fertile belt" is no more appropriate to any part of North America than it would be to Europe. It conveys an erroneous impression, giving the idea that there is only a narrow belt fit for agricultural purposes in comparison with the vast areas north of the 49th parallel.

OTTAWA, November, 1880.

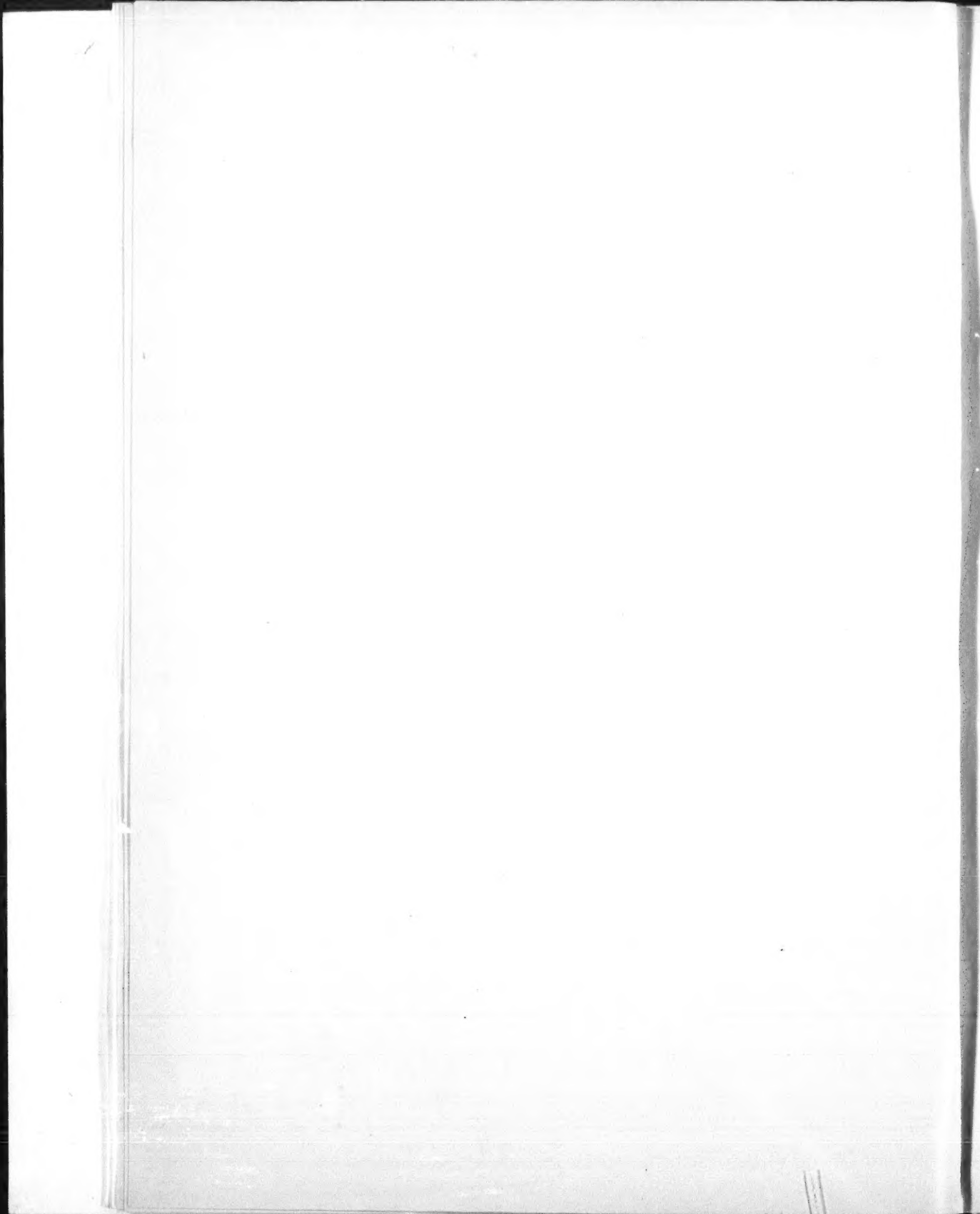
CONTENTS.

LETTER PRESS.

	PAGE
Preface	3
Introduction	7
I. Provinces of the Dominion	9
II. Currents of Air and Ocean in connection with Climates, Regions of Summer Rains and Summer Droughts	11
III. Forest, Prairie and Desert	15
IV. Conifers and Mixed Forests	17
V. Hydrography of Canada	19
VI. Grasses	23
VII. Wheat, Barley, Rye, Oats, Root Crops, Vegetables	25
VIII. Maize, Grapes	31
IX. Orchard Fruits—Apple, Pear, Peach, Plum, Cherry; Smaller Fruits... ..	33
X. Notes on Geological Map	37

MAPS.

	PAGE.
I. Provinces of Canada	9
II. Currents of Air and Ocean, Regions of Summer Rains and Summer Droughts, Summer Isothermals	11
III. Forest, Prairie and Desert	15
IV. Conifers and Mixed Forests... ..	17
V. Hydrography of Canada... ..	19
VI. Zone of the Grasses	23
VII. Zone of Wheat, Barley, Rye, Oats, Pease, Root Crops, Vegetables.	25
VIII. Maize and Grapes	31
IX. Orchard Fruits; Smaller Fruits.	33
X. Geological Map	37



INTRODUCTION.

THE DIFFUSION OF PLANTS over the surface of the earth is regulated chiefly by climate, embracing in that word, temperature and humidity.

Climates are modified by latitude, by ocean and aerial currents, vicinity to or distance from the ocean, position on the continents, elevation above the sea, &c

Heat and humidity are the chief elements favourable to the growth and maturity of plants. In the tropics these two elements of climate are at a maximum. In certain positions on both continents there are immense regions with high summer temperatures, but with a deficiency of rain. These regions, beginning on both continents on western coasts and near the same latitude, extend in the direction of the prevailing winds, north-eastward in the northern, and south-eastward in the southern hemispheres. North of these desert and semi-desert areas are the zones of summer rains and moderate summer temperatures, and hence the parts of the earth yielding in the greatest abundance and in the highest excellence the staples of the temperate zones, such as the grains, grasses, vegetables, fruits and other food plants; and the home of those domestic animals most useful to man. These zones are represented in the old world by western and north-western Europe, and in the new by Canada.

The plants of the temperate zone have their northern limits fixed chiefly by the mean temperature of the summer months; but the northern limits of many annuals correspond more closely with the isothermal lines of July and August. Maize, for example, will not ripen in a summer under 65° with one month at 67° Fahrenheit. Again, the polar range of perennials, such as the vine and peach, is decided by the temperatures in summer and winter, being limited in the north by the amount of summer heat requisite to ripen their fruit, or by the cold of winter being so great as to destroy the plants.

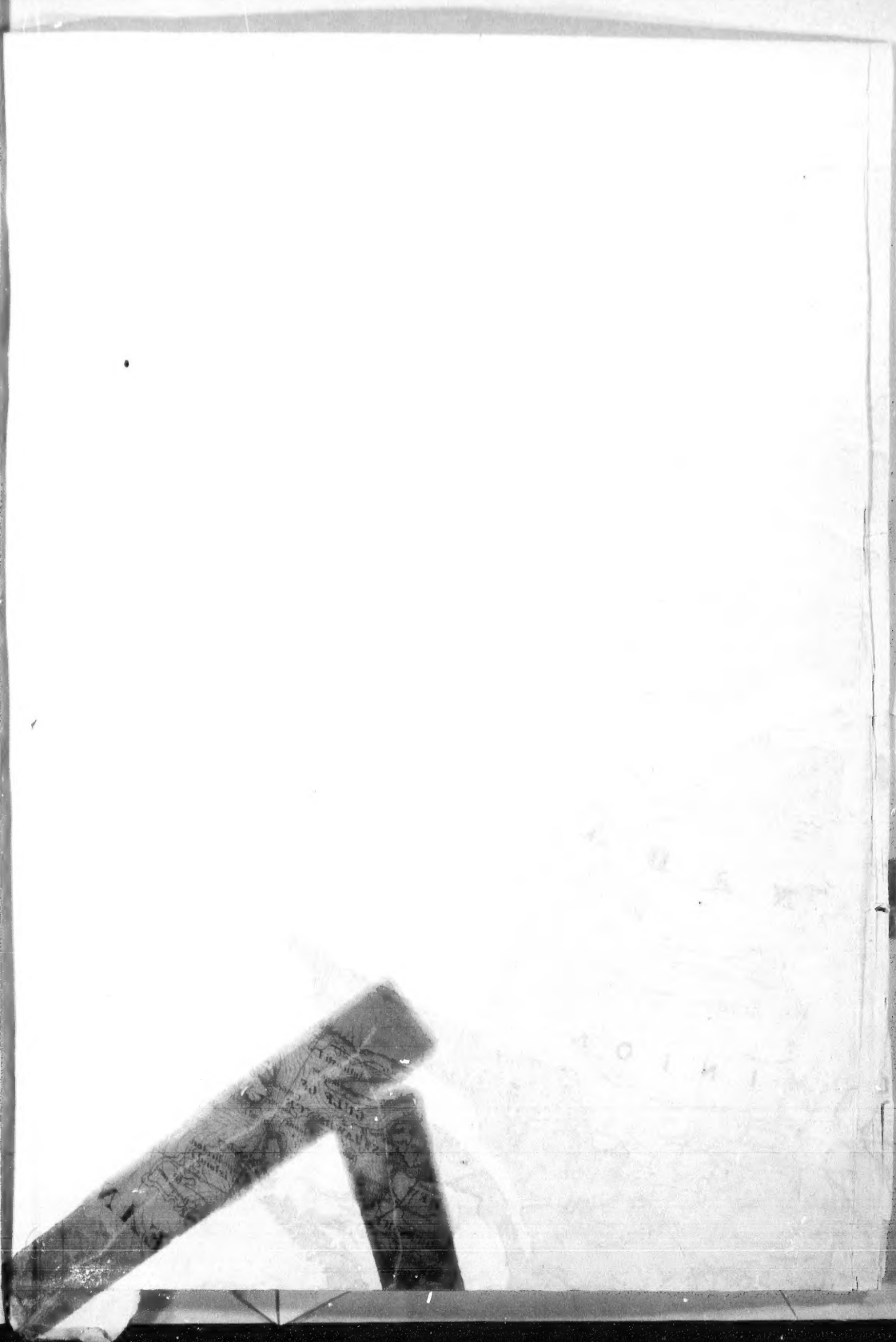
Cultivation extends the limits of plants over a larger area under an equal climate, and increases the capacity of the plant to mature under varied climatic conditions, at the same time often increasing its productiveness. Amongst vegetables, cultivation has extended the potato over a wide area where it was not grown before; and maize, a tropical plant, has, under careful culture, advanced northward to the 56th degree of latitude in the interior of the continent. Wheat, which a century ago was a novelty at Edinburgh, now matures as high as Moray Firth. Flax is a summer crop in northern climates, but a winter crop in climates like Egypt. The same is true of wheat. It is a summer crop in the higher temperate zones, and a winter crop in Egypt, Australia, California, and countries of similar climates, where it is grown in the winter months, ripening its grain before the heat of summer. For such plants the summer heat of low latitudes is too great.

The excessive heat of tropical and sub-tropical countries is injurious, and in many cases destructive,

to perennials of the temperate zones. Vines may grow luxuriantly but will not produce fruit in climates of great heat, such climates as limit the profitable growth of wheat. The cultivation of tropical plants is limited in the north by the frosts of winter. They will vegetate and produce abundance of leaves, much beyond the line where they will ripen their fruit. Maize will grow luxuriantly in northern latitudes in a high summer heat where the season is too short to ripen its grain. The date palm is grown for its foliage on the northern coast of the Mediterranean, where it will not produce fruit.

The cereals, grains and grasses constitute the most important group of plants cultivated as food, and those of the old world are identified most closely with the civilization of the human race. The regions best adapted to these are the middle and higher latitudes of the temperate zones.

fruit in climates
ion of tropical
ce abundance of
luxuriantly in
The date palm
oduce fruit.
ted as food, and
ce. The regions



MAP I.

THE PROVINCES AND TERRITORIES OF CANADA.

THE DOMINION OF CANADA embraces all that part of North America between the Atlantic, Pacific and Arctic oceans, north of the United States, except Alaska. In this we include all British North America, although Newfoundland, an island having about the area of England and Wales, is not a part of the confederation. From east to west, from Belle-Isle to Vancouver, it is over 3,400 miles. It extends from the 56th to the 141st meridians, and from the 42nd to the 70th parallels, or from the latitude of Rome in Italy to the Arctic ocean, 2,000 miles. The superficial area of Canada, without including many islands north and north-east of Hudson Bay is between 3,000,000 and 4,000,000 square miles. The climates of the eastern and north-eastern parts north of the St. Lawrence, embraced under the general name—Labrador, are unfavourable for farming purposes from causes stated in the notes on the maps, but the other parts of the Dominion have climates similar to those of Europe from the Mediterranean to the Arctic ocean. The causes referred to—the cold Arctic currents—which depress the temperature of the north-eastern parts of the continent, bring with them abundant compensation for the barrenness of the land in the prolific fisheries, extending over 10,000 to 12,000 miles of sea-coast, from the gulf of St. Lawrence along the shores of Labrador and Hudson Bay, through the Arctic and down the Pacific to Vancouver, over vast sea-coasts studded with innumerable islands. These fishing grounds are prized more highly than an equal area of agricultural land, and as nurseries for hardy seamen are invaluable.

Off the coasts of Labrador and Hudson Bay are the great seal fisheries of March and April, and the cod of summer. The salmon, cod, herring, mackerel, shad, halibut and seal fisheries on the banks of Newfoundland, over the vast gulf and around the islands of the St. Lawrence, along the shores of Nova Scotia, New Brunswick, and on the Pacific coast, are too well known to need description. Even at the mouth of Mackenzie river, in the Arctic sea, are very valuable fisheries. The furs, too, from the colder regions of the Dominion are another element of compensation; and the minerals may yet be a great source of wealth.

The ports of the Dominion are nearer the markets of Europe than are those of the United States: New York being 3040 nautical miles from Liverpool, Montreal 2783, Quebec 2645, and Port Nelson, on Hudson Bay, only 2941; and Port Nelson is within 300 miles of lake Winnipeg—the centre of the vast river systems, which drain the entire country between the 49th and 54th parallels from the Rocky Mountains to within less than 100 miles of lake Superior. The Pacific ports of Canada, too, are nearer Japan and China than those of the States. Japan is 4470 nautical miles from San Francisco, but Burrard Inlet, the proposed terminus of the Canadian Pacific Railway, 4374. The distances also from the Pacific to the Atlantic ports are less through Canada, for although the continent is broader from

DOMINION OF CANADA

PUBLISHED BY AUTHORITY OF
THE RT HONBLE.
THE MINISTER OF THE INTERIOR

Compiled and Drawn by
A. J. HANSTON, Chief Draftsman.

Fig. 1. Gishardt & Co. Station, Irish Mountains.

ocean to ocean through the Dominion, yet Montreal, 886 miles from the Atlantic, is 2862 statute miles from Burrard Inlet, but New York is 3390 miles from San Francisco, and Boston 3448, being 538 miles in the one case, and 586 in the other, longer than the Canadian route. The Canadian Pacific, too, will cross the continent at a much lower level than any route from the Pacific to the Atlantic through the United States. The highest altitude of the Canadian Pacific would be 3646 feet above the level of the sea, with a remarkably uniform grade through a fertile, well-watered country, with light snows. The railway from San Francisco to New York rises in several places to a height of nearly one and a half miles, and, in one place, to 8240 feet or more than one mile and a half above the sea level, and, for 1300 miles, is everywhere higher than the highest point on the Canadian line. The entire distance from Japan to Liverpool through San Francisco and New York is 12,087 statute miles; but via Burrard Inlet, Montreal and Belle Isle, 11,152 miles, a difference in favour of the Canadian route of 935 miles; and via Burrard Inlet and Port Nelson, the distance would be 9,734 miles, or 2,353 miles shorter than through the United States. This latter route might be used for freight at least from May till October, and although it is here referred to only as a possible route, yet its realization at no distant day is by no means an improbability.

No climate is more healthy than the Canadian. The intelligent reader will at once see the absurdity of the statements in the quotations given in the preface where fevers are associated with frosts and snows, and long winters.

"The ague-breeding-swamps" are quite south of "long winters," south of the frosts and snows of Canada; the great forests of Canada are mixed forests of deciduous trees and conifers, the former being the more numerous in the provinces named; the plagues of grass-hoppers, excepting occasionally on the United States' border, far west of old Canada, and mosquitoes, interfering with farming for even one hour will be new to Canadians; the snows of winter give the best covering to the tender plants, winter grains and grasses; these snows and frosts, too, make natural highways over the unreclaimed swamps and woods, lakes and rivers, on which millions of tons are transported at the lowest cost. Besides, Ontario has a greater length of railway in proportion to its population than any other country, and all Canada nearly three times greater than Great Britain and Ireland, and four times greater than France in proportion to population.

The agricultural capabilities of the Dominion are illustrated by the maps and letter press. In Canada, from the Atlantic to the Pacific, the rains are in summer during the agricultural months; in the United States, from the Pacific to the Mississippi, there is little or no rain in summer. This climatic defect extends from the southern borders of Canada to Mexico, and in the north to Minnesota, Kansas, Missouri, and often to Illinois, and even to other States east of the Mississippi. These differences—the rains in summer in the one region—the Canadian, and their absence or deficiency in the other—make the one a fertile country, and leave the other mostly a barren waste.

862 statute miles
being 538 miles in
vic, too, will cross
rough the United
l of the sea, with
The railway from
iles, and, in one
0 miles, is every-
apan to Liverpool
ontreal and Belle
urrard Inlet and
the United States.
it is here referred
obability.

see the absurdity
l with frosts and

osts and snows of
the former being
asionally on the
for even one hour
unts, winter grains
vamps and woods,
les, Ontario has a
all Canada nearly
in proportion to

letter press. In
al months; in the
er. This climatic
Minnesota. Kansas.
e differences—the
the other—make

TH

DR

NO

W

3

2

MES

LAY

Cha

08

MAP II.

CURRENTS OF AIR AND OCEAN IN CONNECTION WITH CLIMATES; REGIONS OF SUMMER RAINS AND SUMMER DROUGHTS.

THIS MAP is designed to show chiefly the regions of summer rains and summer droughts in North America; the effects of the currents of the air and the oceans on temperatures and rain falls; and the influence of these in producing climates favourable for the productions of the earth. The continent of North America, north of Mexico, is nearly equally divided between Canada and the United States. Canada embraces that part having moderate temperatures, the most uniform rains during the agricultural months, and necessarily the most favourable climates for the production of the chief plants used as food. The arrows on the map indicate the direction of the great currents of the Atlantic and Pacific oceans; the warmer or tropical currents flowing in a north-easterly direction, fall upon and raise the temperatures of western coasts; while the polar currents flow south-westerly down eastern coasts, depressing the temperatures of those parts of the continents.

The prevailing winds in the north temperate zone are from S. W. towards the N. E. This great current of air may be said to be constant north of lat. 35°. In the upper region of the air it blows nearly every day in the year from some point near the South-west towards the North-east. The arrows on the map representing the tropical currents of water also give the direction of the warmer aerial currents. With a constant movement of the air in high altitudes from the S. W. there must be a return current from the north towards the S. W. as there are counter currents in the ocean; but these polar winds near the surface of the earth blow from all points of the compass.

The warm currents of air and water falling upon western coasts, and aerial currents passing over the continents, elevate the temperatures of the western parts of the continents, while the cold currents pressing upon eastern shores, lower the temperatures there.

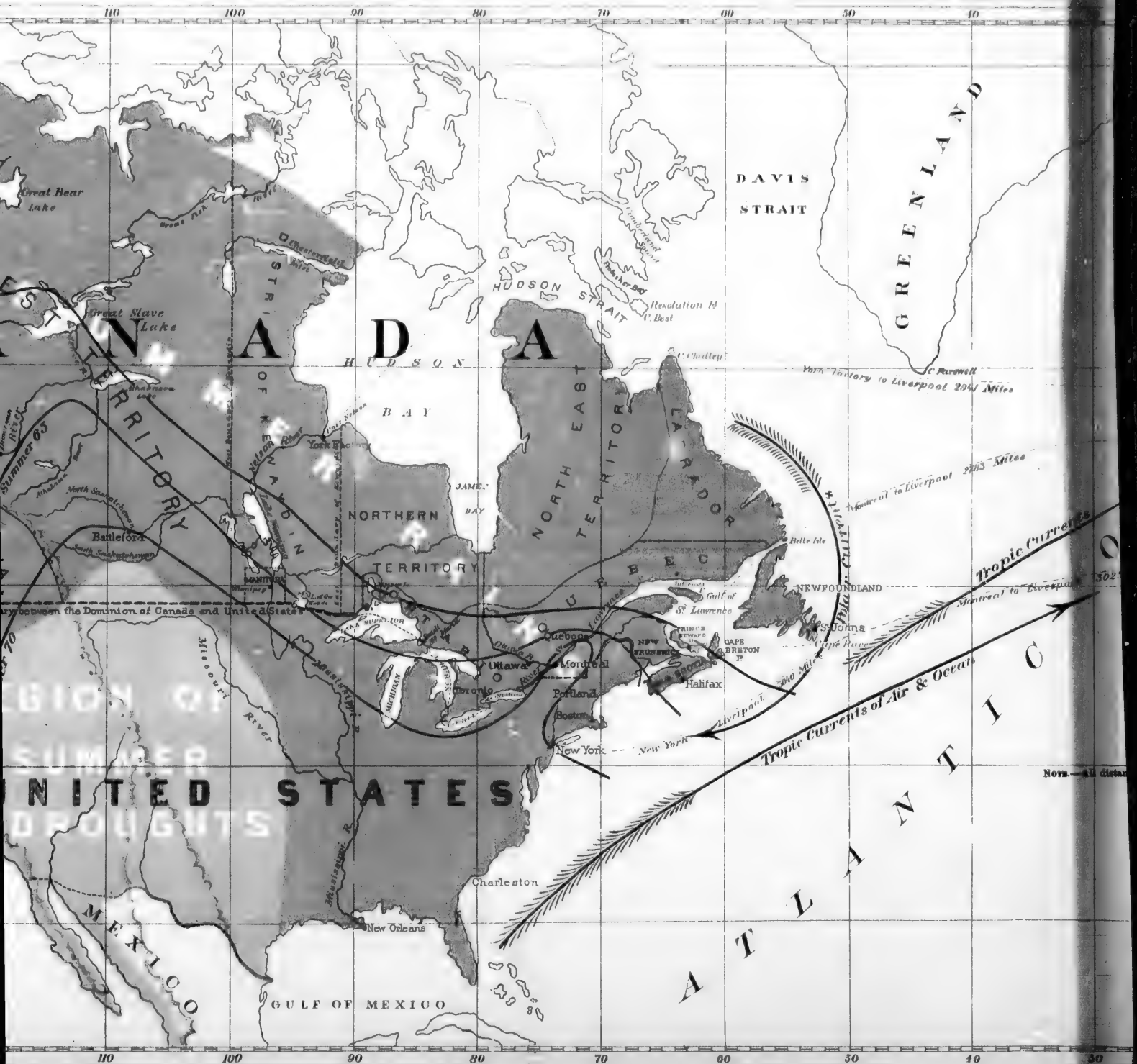
The mean temperature of the Gulf Stream in the Gulf of Mexico is 80° Fahrenheit; its maximum temperature is 86°, or 9° above the ocean temperature due the latitude. Increasing its latitude 10°, it loses two degrees of heat, and after running 3,000 miles towards the north, still preserves the temperature of summer. With this temperature it crosses the 40th degree of N. latitude, and spreading out for thousands of square leagues over the cold waters of the ocean, does much to mitigate the rigours of winter in Europe. When it strikes the British Islands it divides into two parts, the main current going to the Polar Sea, the other entering the Bay of Biscay.

It has been estimated that the quantity of heat discharged over the Atlantic from the waters of the Gulf Stream in winter, would be sufficient to raise the whole column of atmosphere which rests upon France and the British Islands from the freezing point to summer heat. Every western wind which

[MERCATOR'S PROJECTION.]

OUTLINE CHART of NORTH AMERICA with part of EUROPE AND AFRICA.

SHOWING THE
REGIONS of SUMMER RAINS and SUMMER DROUGHTS, also CURRENTS of AIR and OCEAN, in connection with CLIMATE.





Note.—All distances are given in Nautical Miles.

blows, (and the prevailing winds are from the west, or from some point near the W. or S.W. in this part of the ocean,) crosses the Gulf Stream and carries with it a portion of its heat, discharging it in its passage over Europe. The isothermal lines of 60° and 55° , starting from the parallel of 40° on the American coast, run in a north-easterly direction, retaining nearly the same oceanic temperature on the European side in latitude 55° and 60° as exists on the American coast in latitude 40° .

In the Pacific there are tropic and arctic currents like those in the Atlantic, and from similar causes. The Japan stream, or Kuro-Siwo—black stream—a name derived from the deep blue colour of its waters—flows from the south-east of Asia in a north-easterly direction, falling upon the western coast of North America. This stream, flowing many thousand miles further than the Atlantic tropic current, is not so hot nor its littoral waters so cold as those in the Atlantic, but it spreads over the entire pacific coast of Canada. These two currents in the Pacific—the arctic and tropical—produce similar effects to those in the Atlantic; the one warming the western coast of North America, in high latitudes, and the other cooling the eastern shores of Asia.

Through the agency of these two currents in the Atlantic, the western countries of Europe are much warmer than the eastern parts of America in similar latitudes; the difference being about eight degrees in latitude 41° ; eleven and a half in lat. 51° ; and twenty-five in lat. 58° . Similar causes in operation in the Pacific ocean give an equal elevation of the temperature of the western coasts of America over the eastern coasts of Asia in the same latitudes—the arctic currents chilling the one and the tropical currents warming the other.

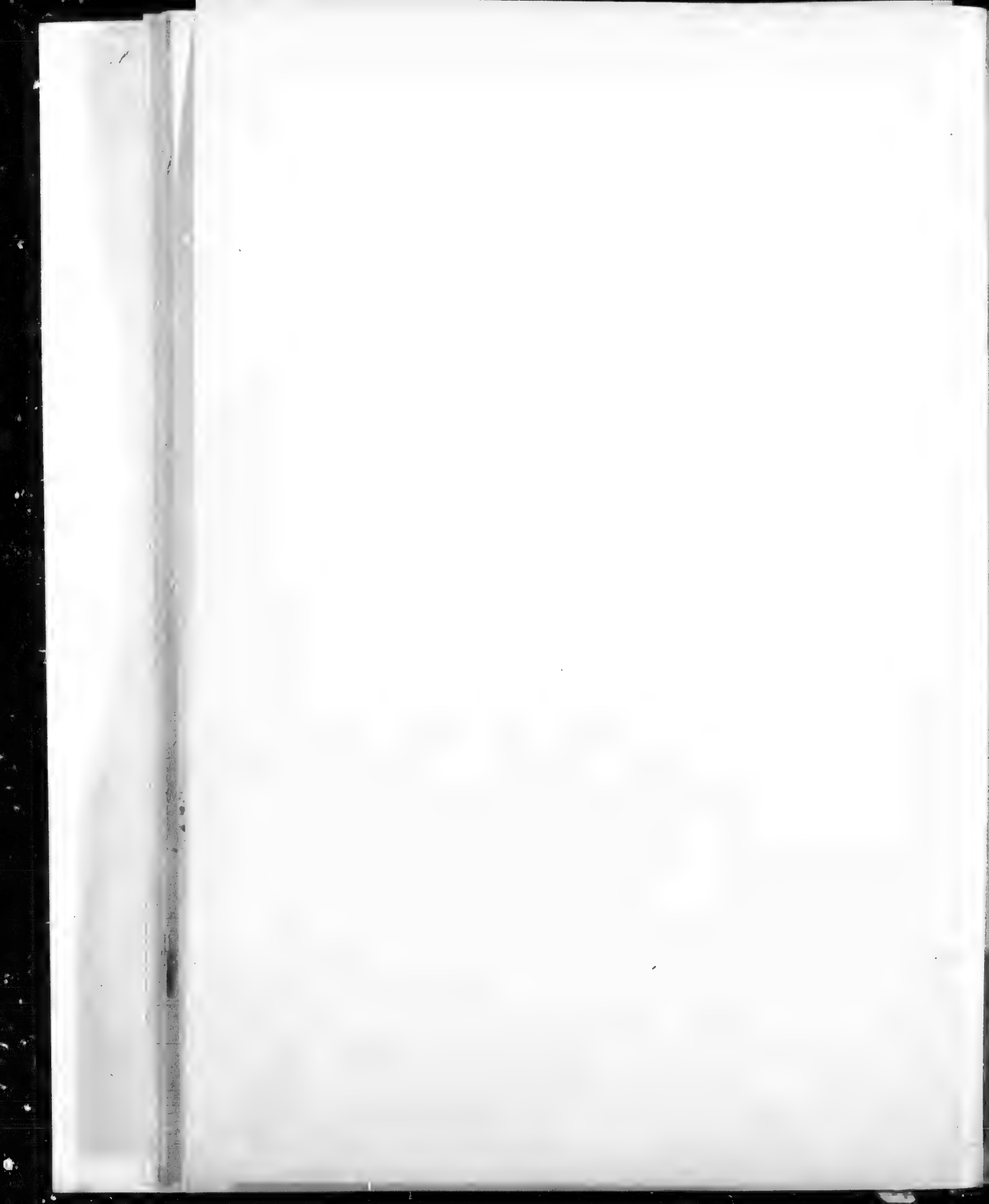
From Vancouver in lat. 49° to Sitka in 57° , the summer temperatures are as high and as uniform as in the west of Europe, except where the vicinity of mountains may modify the normal conditions of climate. Sir John Richardson says "the climate of Sitka" [on the Pacific coast] "is much warmer than that of Europe in the same parallel." (*Ar. Ex.* Vol. 2 p. 279.) The isothermal of 60° for the three summer months rises as high as latitude 68° east of the Rocky Mountains in the valley of Mackenzie river. Youkon, west of Mackenzie river and within the Arctic circle, lat. 67° , has a July of $65^{\circ} 7'$, and an August of 60° .

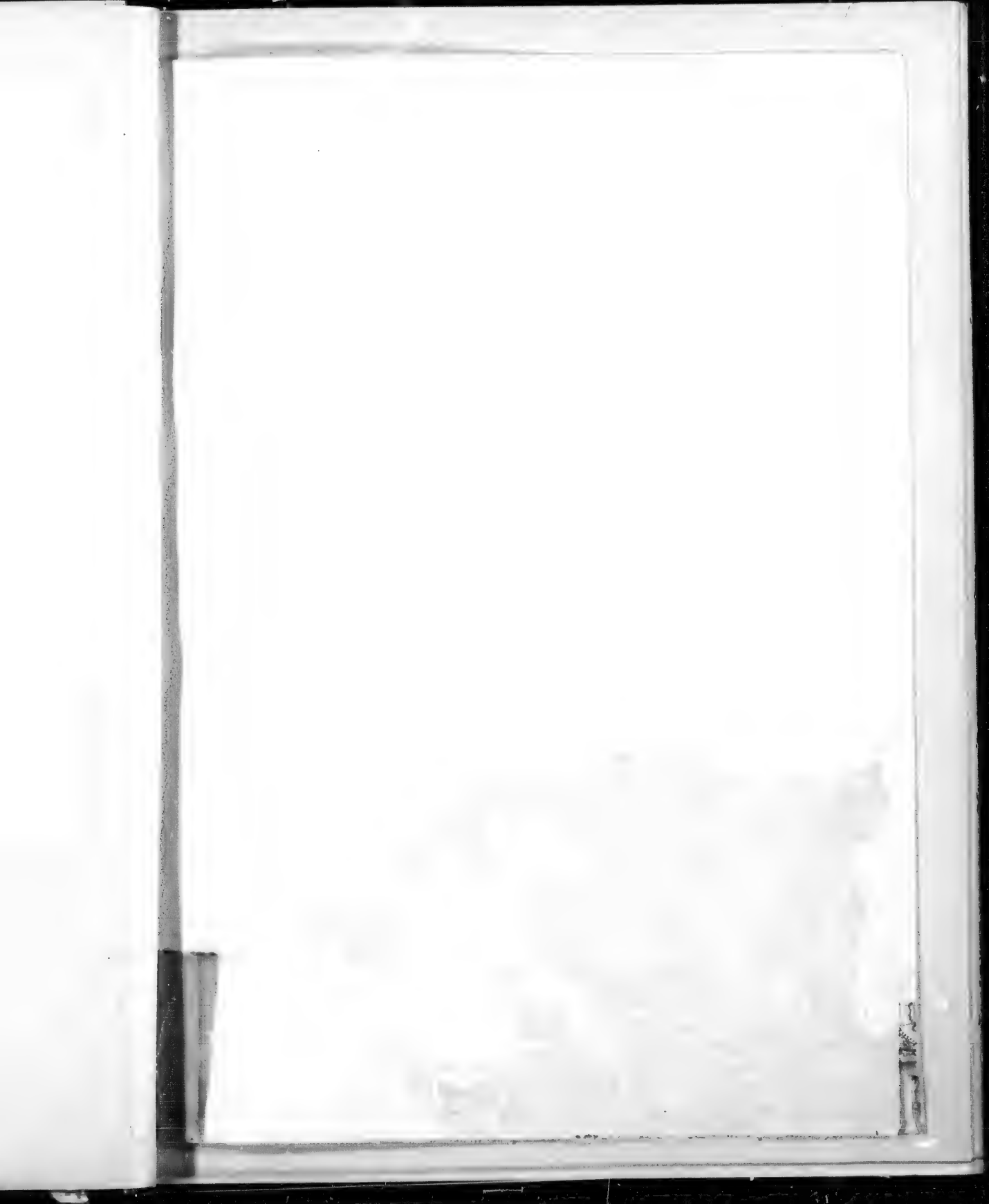
In comparing the well known regions of the old world with the less known corresponding parts of the new; western coasts with western; eastern with eastern; and interior divisions with interior, we find a remarkable similarity in the climates of the two continents. The United States are similarly situated on the North American continent with China on the Eastern; in latitude, in position on the continents, they are the same, and in climates similar. Canton, in China, lat. 28° , has a summer temperature of 82° , and Key-West in Florida, lat. $24^{\circ} 32'$, a summer of 82° . Peking, lat. 40° , has a summer of 76° , which is only two or three degrees above that of Philadelphia, of the same latitude. Mangasaka, Japan, and Charleston in South Carolina, in the same latitudes, have summers of 80° . London, in the west of Europe, and Vancouver, in the west of North America in similar latitudes, have the same mean summer temperatures, about 61° and a half; Sitka in lat. 57° , Sir John Richardson says has a climate much warmer than Europe in the same latitude. The climates of the interior are warmer in summer and colder in winter than those on eastern and western coasts, but are somewhat similar on both continents, being, however, warmer on the Red, Saskatchewan and Mackenzie rivers, than in the same parallels on

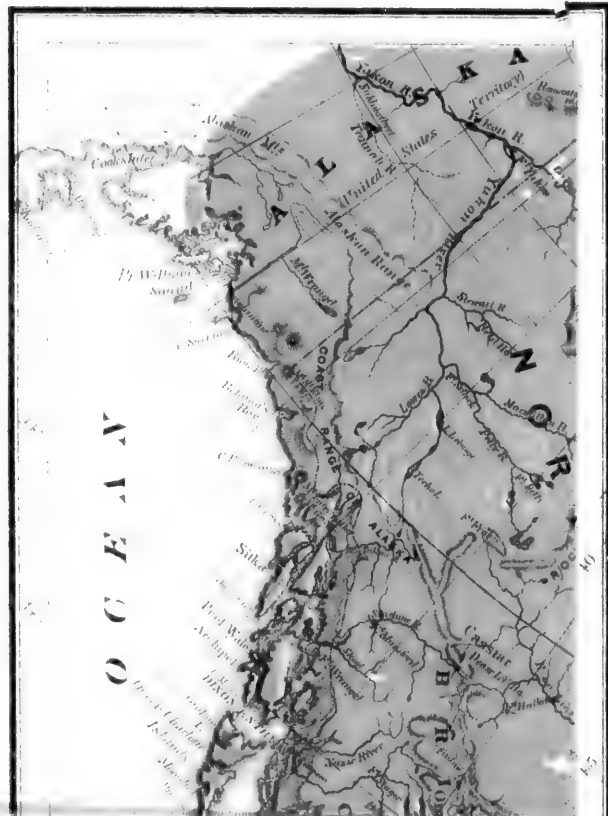
the eastern continent. The isothermal of 65° , for the three summer months, crosses the Red river in latitude 50° , and rises on the Mackenzie to latitude 60° .

The summer rains, too, throughout Canada, are similar to those in Europe in the same latitudes from the Mediterranean to the Arctic, being somewhat uniform during the agricultural months, but more copious in Canada.

South of the boundary between Canada and the United States west of the Mississippi, are the areas of summer droughts—the lighter shades on the maps—a rainless, treeless, desolate region, similar in position on this continent and in the character of the country to the desert areas of the old world—the one beginning on the western coasts of Mexico and California and extending to British America on the north, and over half the continent eastward; the other beginning on the western coast of Africa near the same latitude as the American desert, and extending north-eastward or east by north over Africa, Palestine, Independent Tartary and Manshire Tartary, nine thousand miles in the direction of the prevailing winds.









MAP III.

FOREST, PRAIRIE AND DESERT.

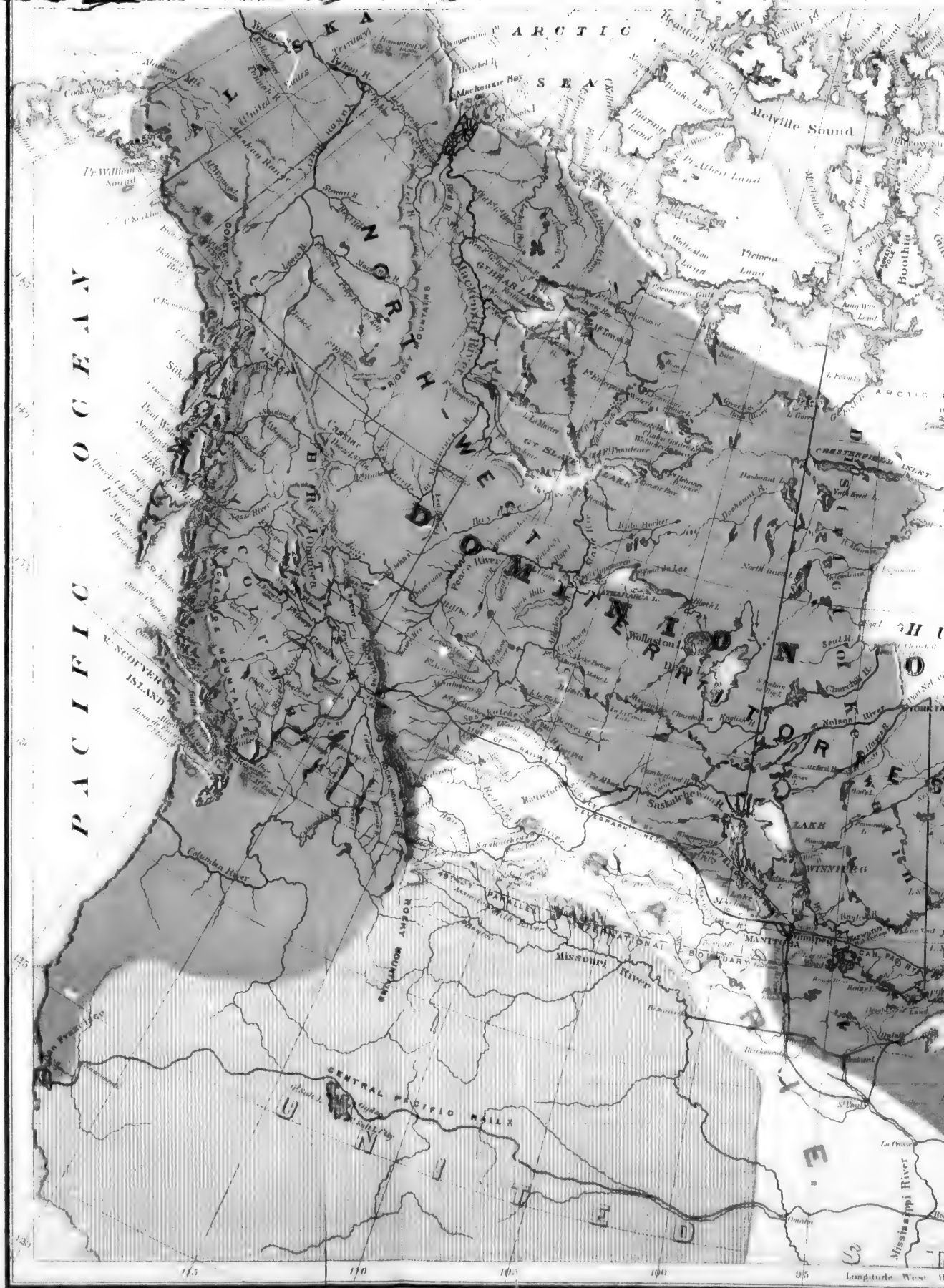
From what has been said in the notes on the previous map, the physical features of this map are readily inferred. The uniform rainfall, during the summer months, throughout Canada and the eastern half of the United States with the summer temperatures varying from 50° to 80° , are conditions favourable to the production and growth of forest trees. The absence of rain in the western half of the United States, is a sufficient cause for the absence of all vegetation except the cactus and artemisia or sage of the desert, emblems of an arid region. This part of the continent, like the desert of Sahara, is rainless, treeless, and desolate. It extends from about the 100th meridian to the western slope of the Pacific, which latter, Major Emory, surveyor of the Mexican boundary, calls a narrow belt seldom exceeding 200 miles in width and sometimes not more than ten. (*Am. Ex. Doc. vol. 14, 1835-6.*)

Between this arid region and that of the regular summer rains to the north and east—the areas of the woodlands—lie the prairies. In these grass zones there is not rain enough to produce trees, but enough to keep alive the wild grasses. The tops of these prairie grasses die during the droughts of summer, but the roots have vitality enough to germinate again under the rains of spring. Trees, which may have been killed by drought, have no such vitality.

The part north of the 49th parallel, marked in Map No. 3, as a continuation of the region of summer droughts, is found, by recent explorations, to be good pasture land, excepting that south of the Cypress hills which is only of second quality.

North of the parallel of 49° , east of the Rocky Mountains, there are about 120,000 square miles of prairie, an area equal to Great Britain and Ireland. Between this and the North Saskatchewan the prairie land predominates, but is interspersed with groves. North of the Saskatchewan the forests predominate, there being not more than one-third prairie. Along the eastern base of the Rocky Mountains, and extending up into the recesses of the mountains, is a belt of conifers, the principal tree being the Douglas pine, (this tree is however an *abies*.) and the white and black spruce. East of these mountains, the water sheds are mostly covered with heavy forests of spruce, but the dry ground, where there are trees, with poplars (*populus tremuloides*.) In the damp forest lands near the mountains, balsam poplar is found in some abundance, and this is the species which grows to such an enormous size on the Athabaska, Peace and Mackenzie rivers; all the islands in these rivers being covered with trees of this species, often seven to ten feet in diameter and one hundred feet in height.

In the eastern parts of the territory the banksian pine is a small tree seldom attaining twelve inches in diameter; but on the southern shores of Hudson Bay it is found two feet in diameter and one hundred feet in height. Another small pine (*pinus contorta*) ranges from the head of the Athabaska





through the Rocky Mountains and forms thick forests of many miles in extent in upper British Columbia west and north of the Frazer river.

The forests of British Columbia, west of the Cascade Mountains, are very fine, and here the Douglas-pine or Douglas-spruce (*abies Douglasii*) and giant cedar attain their greatest dimensions. East of the Cascades the forest clings about the mountain tops, but the trees are much smaller. *Pinus ponderosa* is in some abundance on the Thompson river, and has much the appearance of red cedar. On the western slopes of the Rocky Mountains are many species of fir and pine, which in the near future can supply the eastern plains with enormous quantities of first class timber. (*Letter of Prof. Macoun*).

The comparative value of prairie and woodland is a question often discussed. The absence of trees is undoubtedly caused by climatic defect, and this defect is manifestly the deficiency of moisture. The areas of summer droughts in the old and new worlds are identical with the treeless areas. This climatic defect must operate permanently and with increased intensity upon plants. A climate destructive to trees could not be propitious to fruit trees, nor indeed to the staples of the temperate zone.

Temperature and rainfall during the summer months are the conditions of climate most favourable to the productions of the earth. The absence or deficiency of one of these elements must necessarily render climates less propitious to plants. Forest lands are permanently most profitable and produce most uniform crops. No doubt the preference is given to prairie lands in the first instance, from the greater ease in bringing them under culture; but the chief consideration should be the permanent quality of the soil and climate, and not the facility of beginning. Prairies in the higher latitudes, as in Minnesota and especially in and west of Manitoba, have a greater rainfall and more humidity, and sufficient to produce fine crops. But these are on the northern limits of the prairie lands.

MAP IV.

CONIFERS AND MIXED FORESTS.

The cone bearing trees are found in a broad belt west of the Rocky Mountains, sweeping around the shores of the North Pacific and Arctic seas, down the coast of Hudson Bay and Labrador and across the St. Lawrence, keeping in the cooler and more humid climates of the Pacific, Arctic, and Atlantic oceans. These forests are also mixed with white birch and poplar.

In the interior of the continent, where the summer temperatures range from 60° to 80° with somewhat uniform summer rains, are found the great mixed forests of North America, the most remarkable forests of deciduous and coniferous trees on the globe. These forests are made up of some sixty to seventy trees and forty to fifty shrubs. The greater part and much the most valuable part of these forests are in the Dominion of Canada.

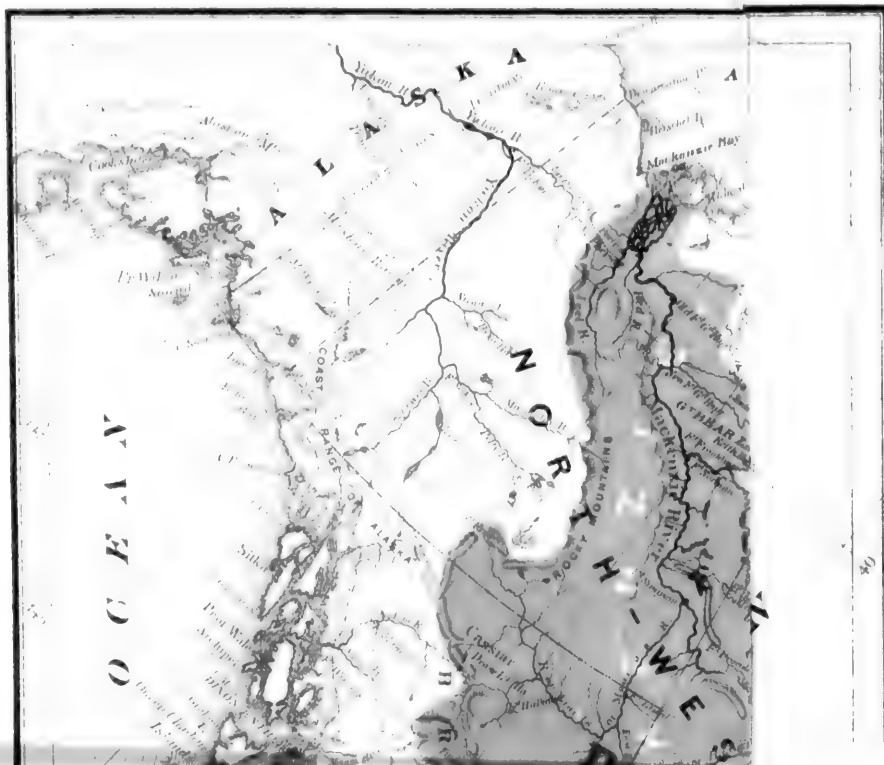
In going northward from the United States boundary at the Lake of the Woods by way of Winnipeg river and lake, the Nelson river and the sea-coast northward. Mr. Bell found the trees disappearing in the following order—basswood, sugar maple, yellow birch, white oak, soft maple, grey elm, white and red pine, red oak, black ash, white cedar, serrated leaf poplar, mountain ash, balsam fir, white birch, banksian pine, balm of gilead, aspen, tamarac, white and black spruce. (Geo. R. 1879, p. 28, cc). Black spruce is found some distance beyond Seal river, lat. 59°, long. 96°. Here Mr. Bell found black spruce three feet in diameter and 100 feet in height. (id. p. 29 cc). Balsam poplar 6 to 10 feet in diameter is found on Peace river, and very abundant. White spruce three feet in diameter is also found at Fort Simpson, lat. 62° 5'. (*Prof. Macoun.*)



2-11-94



Nº 5.



MAP V.

HYDROGRAPHY OF CANADA.

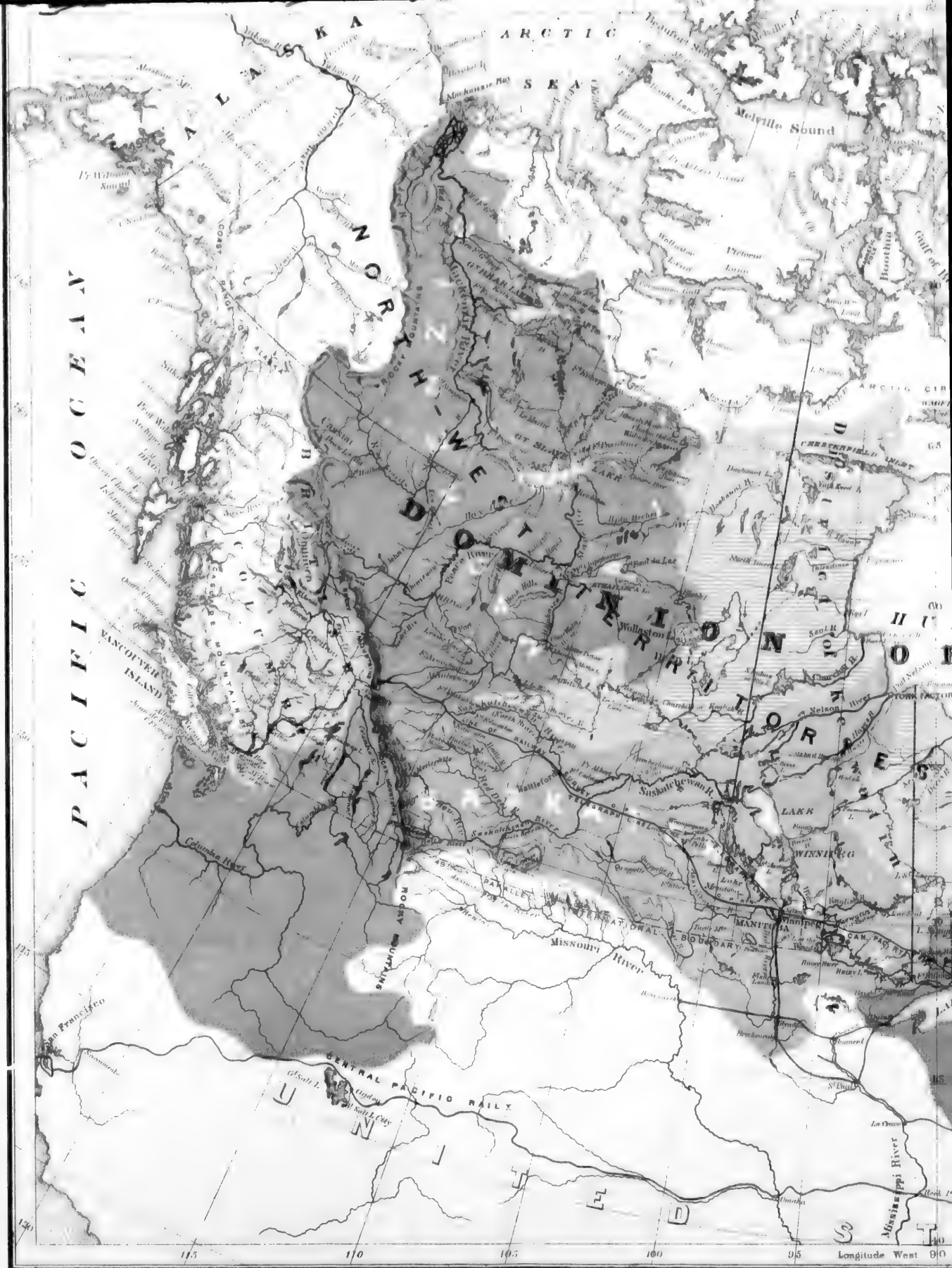
The water in the lakes and rivers of a country is a somewhat accurate measure of the surplus rain-fall over the evaporation. In England from 40 to 60 per cent. of the rain passes off in the form of vapour, leaving 60 to 40 per cent. in the lakes and rivers and soil of the country. In the desert areas almost the entire, and in many parts, the entire deposition is evaporated. In such regions there are few or no fresh water lakes and but small streams, as in the great deserts of the earth,—the desert of Sahara and its continuation north-eastward through Palestine, Independent Tartary, and Manshire Tartary, the centre of Australia, and over the vast regions of summer droughts, between the Mississippi and the Pacific, within the United States of America. These deserts are also called "riverless regions." In such arid tracts, where the evaporation exceeds the rain-fall, the lakes are salt, as the Great Salt Lake of Utah, the Dead Sea, the Caspian and the Aral. Even east of the Mississippi there are few lakes within the United States compared with those in Canada, except in the north and those connected with the St. Lawrence. Even in the latitude of Washington and Baltimore, the evaporation in summer is twice the rain-fall.

Canada, situated in the middle and higher parts of the temperate zone, lies in the region of summer rains and moderate summer temperatures.

The numerous lakes and rivers over this vast territory, are the expression, the index of the rain-fall over the evaporation. In any good map of Canada one may count from 500 to 1000 lakes, and lake-like expansions of rivers. These lakes and rivers not only give a more beautiful and varied aspect to the scenery, but add to the salubrity of the climate, the cool humid breezes from which temper the heat of the long summer days, and the larger ones, never freezing, soften the severity of winter.

No country presents a greater variety of lovely and magnificent scenery than this land of a thousand lakes.

The chief physical features which it is necessary to refer to in considering the rivers of North America, are the Rocky Mountains, the Alleghany in the east, and the Laurentian between the St. Lawrence and Hudson Bay. These are the great water-sheds of the river systems of the United States and Canada. The continent, which is about two miles high in Mexico, and narrow from ocean to ocean falls to a lower level northward, spreading out like a fan. Through the central parts of the United States' Territories it still retains an altitude of one mile to a mile and a half, but north of 49° falls to 1,000, 800, 600 and even to 400 feet above the sea level. Lake Superior, 2,000 miles inland, is but 600 feet above the ocean; lake Winnipeg 700; Athabaska 600; and the country between lake Superior and Hudson Bay, north of the height of land, under 400 and 500 feet. Hence the general course of the great rivers of the Dominion, east of the Rocky Mountains, is north and north-eastward.





The rivers and lakes of Canada are its most remarkable physical features. We notice chiefly the three great river systems as more intimately connected with our subject:—the St. Lawrence, Winnipeg and Mackenzie. The first and last of these drain areas of from 500,000 to 550,000 square miles, and the Winnipeg some 400,000, together forming water courses with few breaks from the gulf of the St. Lawrence, on the Atlantic, to the mouths of the Mackenzie on the Arctic ocean in latitude 69° , a distance of 6,000 miles.

The Rocky mountains are the water shed of the rivers of the interior and the Pacific slope. The Laurentian chain, extending from Labrador to the west of Hudson Bay, divides the waters falling into the St. Lawrence from those flowing northward into that bay.

The St. Lawrence below Quebec forms a broad estuary and enters the gulf, at Gaspé point, by a mouth more than 100 miles in width. It is fed by many great rivers from the north, but no stream of any importance enters it from the south, except the St. John, St. Francis and Chaudière between Montreal and Quebec.

Sir William Logan, in his Geological Reports, gives the basin watered by the St. Lawrence at 530,000 square miles,—70,000 of these being in the United States. But including the gulf and the islands, which may be considered a part of the valley of this great river, there would still be more than half a million square miles in Canada: and the fishing grounds in and around the gulf are among the most valuable possessions of the Dominion.

The great lakes of the St. Lawrence are situated on four plains or plateaux, rising one above the other, from lake Ontario, the surface of which is 232 feet above the ocean, to lake Superior, 600 feet above that level. The beds of these lakes form the most remarkable depressions on the continent. Lake Ontario, having an average depth of 600 feet, has a basin 368 feet below the level of the sea, and some parts of it 1,500 feet. Lakes Superior and Michigan, if not Huron also, are 800 to 1,000 feet deep the beds of which would be 300 to 400 feet below the surface of the ocean.

Lake Ontario, the smallest of these lakes, is oval shaped, 180 miles long, and in the widest part 60 to 70 miles; lakes Erie and Huron each 240 miles long; Michigan 320; Superior 400, and in some places 200 miles from shore to shore, having a superficial area of 32,000 square miles. Michigan and Huron about 22,500 each.

The waters of these lakes and rivers are remarkably transparent. It is not uncommon for a voyageur to see the bottom to the depth of 50 feet, and those who have been much on lake Superior say to the depth of 200 feet.

The St. Lawrence and its lakes are estimated to contain 12,000 cubic miles of water, or more than half the fresh water on the globe. The water passing over the falls at Niagara is estimated at twenty million cubic feet per minute, and as this does not represent more than half the rain-fall upon the area drained above the falls, an equal quantity must pass off in vapour.

The chief rivers which pour their waters into lake Winnipeg, are the Saskatchewan and Assiniboine from the west, the Red river from the south, and Winnipeg from the east. The largest of these,

the Saskatchewan (the water that runs rapidly) rises in the Rocky mountains in numerous streams, between 49° and 53° north latitude. The confluence of these tributaries forms the two branches of the Saskatchewan, which, after diverging more than 300 miles, meet some 800, or following the course of the streams, 1,000 or 1,200 miles from their sources, whence the united Saskatchewan runs 280 miles to its embouchure in lake Winnipeg. The Assiniboine has its sources in the high lands between the parallels of 49° and 53° and between the 105th and 110th meridians West. The two chief branches of the Assiniboine—the Qu'appelle and Souris—unite 500 miles from their sources and 200 from the Red river, which the Assiniboine joins at the city of Winnipeg. The Red river rises about latitude 46° , near the sources of the Mississippi, in the high lands west of lake Superior and 350 miles south of lake Winnipeg into which it flows after being joined by the Assiniboine. The Winnipeg river is the outlet of the vast system of lakes and rivers lying between lakes Superior and Winnipeg—the Lake of the Woods, Rainy lake and Rainy river, English river, Lonely lake, and dozens of other lakes; for the whole region between lakes Superior and Winnipeg is full of lakes. The waters here in the granitic formation, as also in the Silurian and Huronian, spread over the country in numerous lakes and rivers. From the Lake of the Woods the river falls some 500 feet in its course of 125 miles, and though not navigable for steamers, was for two centuries the route by which the trade of the interior was conducted by the great fur companies.

The outlet of lake Winnipeg through Nelson river is about 50 miles south-east of the northern angle of the lake. Thence to York factory on Hudson Bay is 300 miles in a straight line, or 400 following the course of the river; 100 miles of which from the bay is navigable for large steamers. The river at its mouth at high tide has a breadth of 6 or 7 miles, but it contracts rapidly, and for the first ten miles the width is from three to four miles. Narrowing to the head of tide water, 24 miles up, it is one and a half miles wide. Above this it varies from one half to one mile, with 20 to 40 feet of water, and a velocity of $2\frac{1}{2}$ to 3 miles an hour. At the mouth of the river, spring tides are about 12 feet and neap tides 6 feet. In following the river downward, Mr. Bell found another 150 miles in one place navigable for steamers. (Geo. R. 1877-8.) The Nelson river, however, could not probably be used as a means of communication between Hudson Bay and lake Winnipeg. This river Mr. Bell estimated to have four times the quantity of water of the Ottawa at the Chaudière falls, which would give it a volume equal to the St. Lawrence at the falls of Niagara. This estimate would not be improbable as the Nelson is the outlet of an area much larger than the St. Lawrence above the Niagara falls, with a somewhat similar rainfall. Below Sipi-week lake, 120 miles from lake Winnipeg, all the waters of the Nelson unite for the first time after leaving Play-green lake near lake Winnipeg. The channel is here one-fourth of a mile wide, and from 40 to 50 feet deep, with a current of three miles an hour.

The Mackenzie is the largest river which contributes its waters to the Arctic ocean in the western hemisphere. It is about 2,500 miles long, and following the windings of the stream, probably 3,000 miles, with 2,000 adapted to steam navigation. The area drained is 550,000 square miles. It takes its rise in the Rocky mountains chiefly in the second and higher peak or the Cascade range, between latitudes 53° and 57° , and longitudes 117° to 127° west. The chief branches which by their confluence form the Mackenzie are the Peace and Athabaska rivers. The first, rising between the 54th and 57th parallels, and 120th

and 127th meridians west in the high and unexplored regions of the interior, breaks through the eastern or Rocky Mountain chain, and after a course east by north of more than a thousand miles, joins the Athabaska river, north of Athabaska lake, near latitude 58° . Thence to Great Slave lake, the united stream is called Slave river. The chief tributaries of the Peace river are the Pine, Smokey, Parsnip and Finlay.

The sources of the Athabaska are near latitude 53° , and between longitudes 117° and 119° in the eastern range of the Rocky Mountains; its general course is north-eastward for 1000 miles to the lake of the same name. The Pembina, Slave, McLeod, Rocky and several minor streams contribute their waters to the Athabaska. From Great Slave lake to the ocean the river bears the name of its discoverer, Mackenzie, who passed down it in 1793. From Athabaska lake to the Arctic sea, the Mackenzie is fed by many large rivers and lakes, the chief being the du Liards, or Mountain, from the west, 750 to 1000 miles long; and the du Rocher from the east, a tributary of Great Slave lake. The vast systems of lakes and rivers centring in the Athabaska, Great Slave, and Great Bear lakes, also give their waters to the Mackenzie.

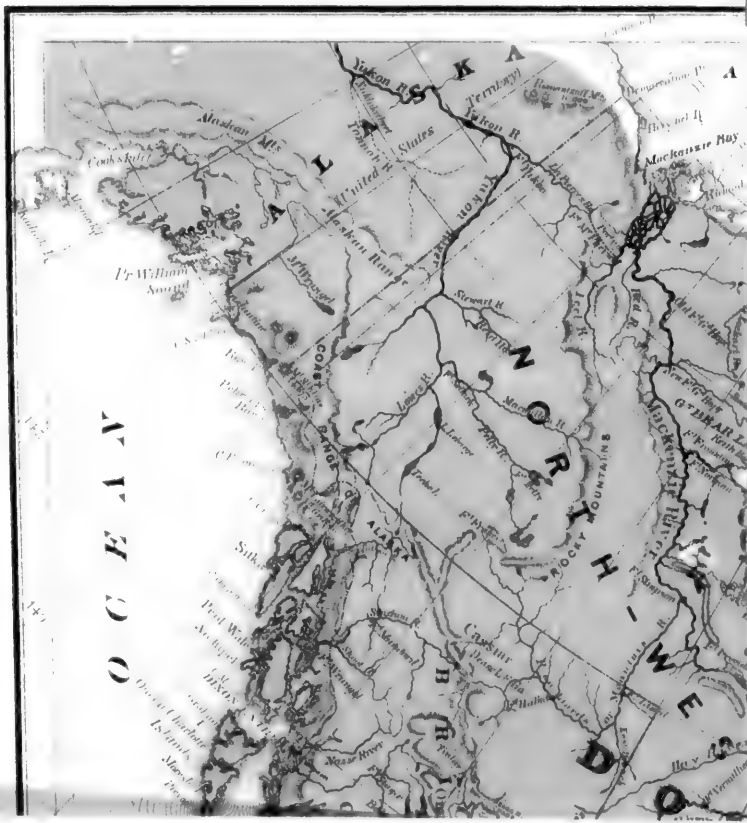
The country on the western, southern, and eastern shores of Hudson Bay, which contributes its waters to that inland sea, is probably twice the area of the valley of the St. Lawrence. This vast region is but little elevated above the ocean, and is represented to be a level country with an alluvial soil or loam and clay of good quality, well wooded and watered by numerous rivers. There are at least twenty to thirty large rivers, a dozen of which would, in Europe, be called first class; such as the Albany, Moose, Abbitbee, Harricanaw, and Notaway on the south; Rupert, East Main, Great and Little Whale on the east, and the Nelson, Severn, Hayes, Churchill and Doobaunt on the west. The Churchill, 700 miles long, runs through 17 degrees of longitude and is the outlet of numerous lakes and tributaries. The Albany is from 500 to 700 miles long and drains a vast country over ten degrees of longitude lying south-west of James' Bay.

Most of the grains and vegetables of the middle temperate zone come to maturity wherever planted in the country to the south, east and west of James' Bay; but judging from the temperature and rain fall, no doubt that entire region would be best adapted for pasture and meadow lands. The parts of Hudson Bay around which this vast country lies, are nearer Liverpool than New York,—Port Nelson, on Hudson Bay, being 2,941 miles and New York 3,040 miles from Liverpool. Agricultural products would, by being shipped from that bay, save the cost of 2000 miles of inland carriage, and agricultural products are heavy of transit. The ports are open from May till October, and that route has, for two hundred years, been used by the Hudson Bay Company. A charter for a Railway from Lake Winnipeg to Hudson Bay has recently been obtained.

a
l
o
e
e
r
l
o
f
o
s
n
r
y
,
s
e
g
d
n
of
n
l,
is
d
o



GNP 5.



MAP VI.

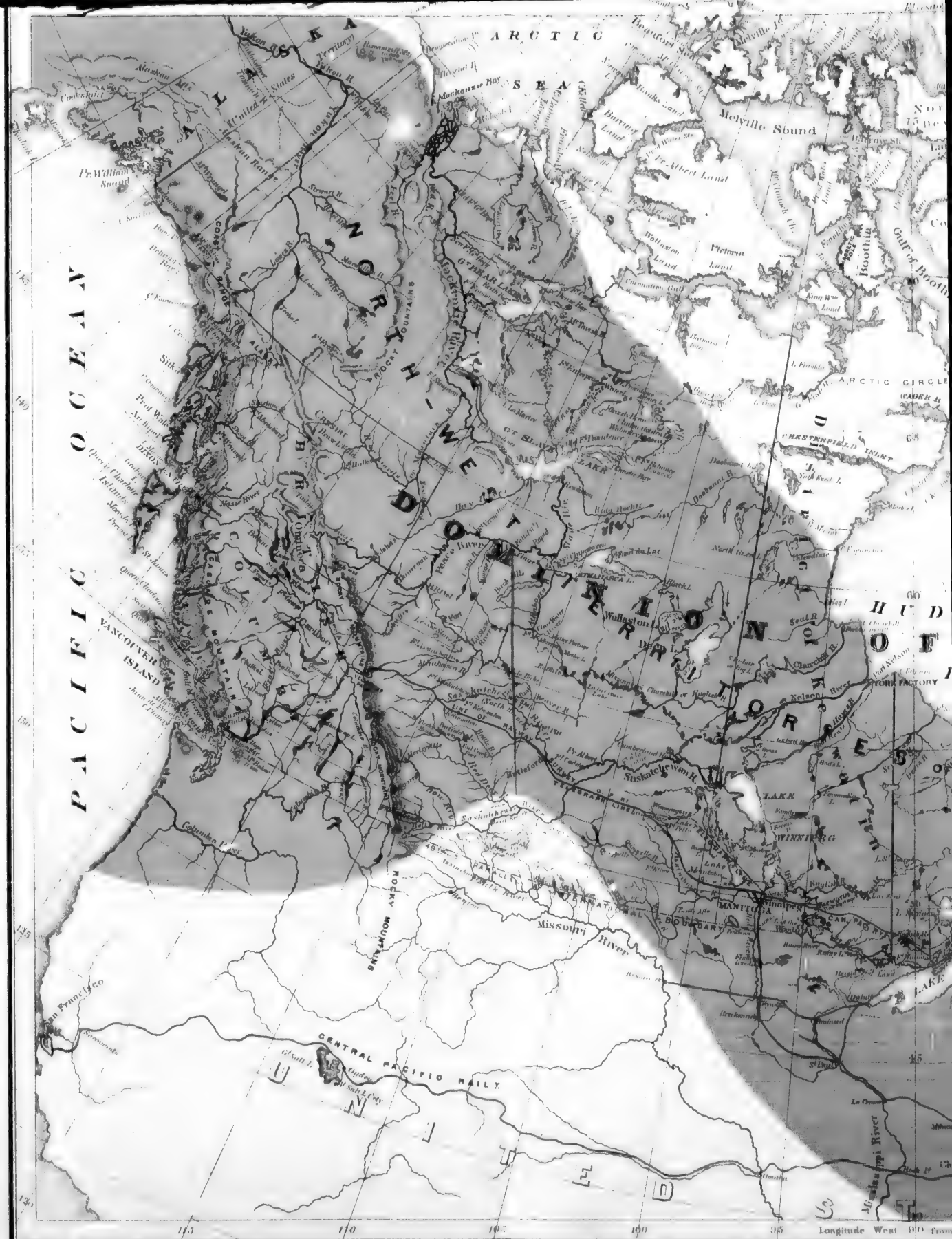
GRASSES.

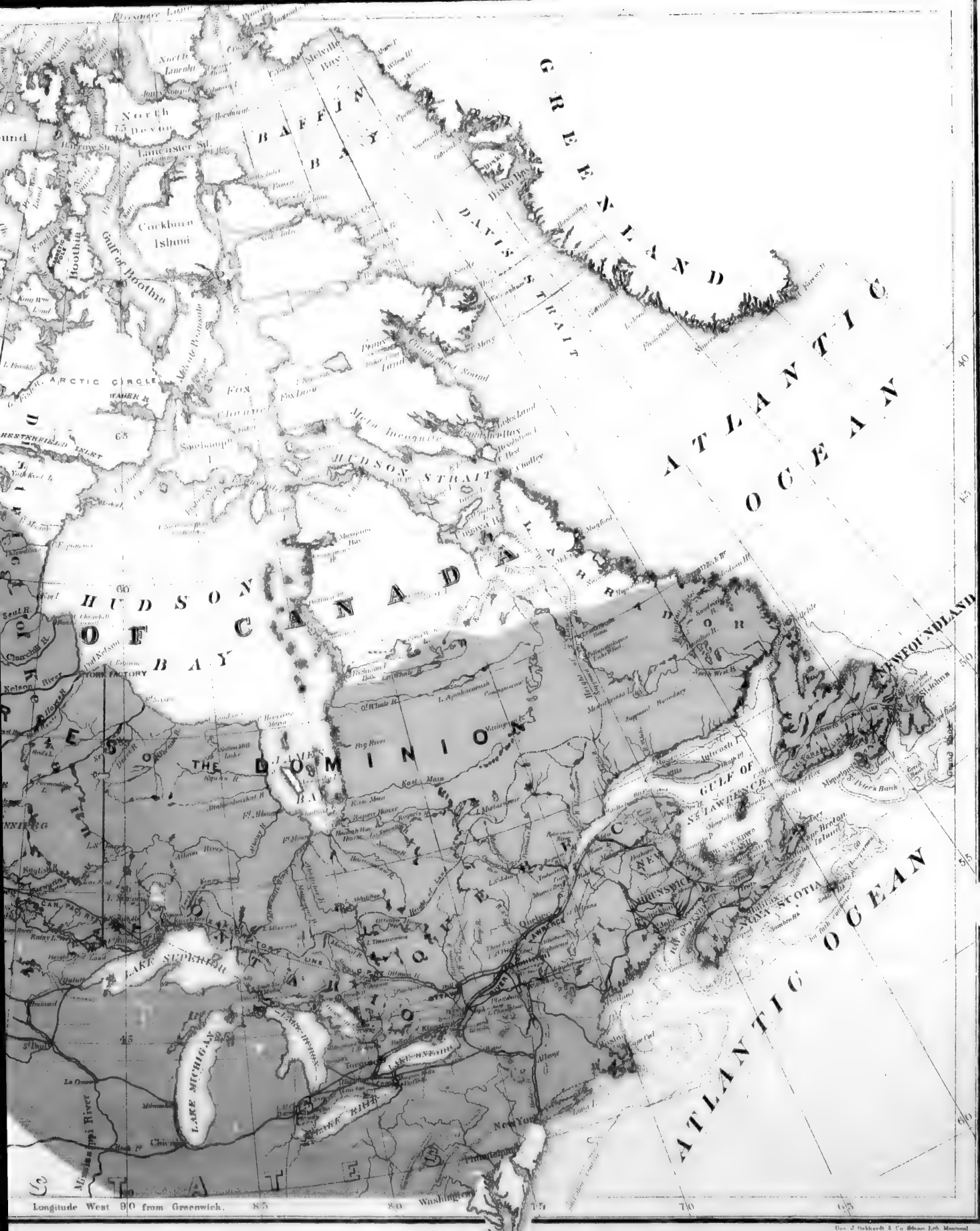
The region of the cultivated grasses (timothy and clover chiefly) is identical with that of the summer rains, roughly sketched in the temperate zone of this continent by the presence of forests; where these do not exist the cultivated turf cannot be produced, unless in the higher latitudes and in a humid atmosphere. Hence the vast areas of the western states, even east of the Mississippi river, unfavourable for pastures and of course for the dairy. West of that river, pastures of these grasses almost wholly fail. As a general rule the cultivated grasses fail south of latitude 39° east of the Mississippi, and at a much higher latitude west of it.

To show that the United States are not here depreciated as a region for the grasses, quotations are given from the chief American author on the subject, Blodget's *Climatology of the United States*, Ch. XV.

"Nearly all the cultivated forms of grasses," says Blodget, "are derived from England. They find decided limitations in the climate consequently [of the United States] and are very far from supplying the requirements here. Cultivable grasses are needed, which will bear a higher summer heat, and the summer aridity which is so general in the districts now occupied by native grasses only, which yet show no adaptation to the necessary re-seeding and frequent change required in all cultivated districts. The cultivable turf made up of some of the many varieties of grasses, belongs most decidedly to the districts of equally distributed rains above the 39th parallel, and it is rare from Baltimore [latitude $38^{\circ} 18'$] to Washington [latitude $38^{\circ} 58'$] unless carefully preserved, as at all points near this latitude east of the Mississippi river. Within the area north of the 39th parallel there are many limitations, and it may be more precisely set down as coincident with the great mixed forests, failing where these fail, either on sandy tracts or prairies. For the sandy plains of New Jersey and in some parts of New England the English grasses fail, though the cause is not climatological [?] But on the prairies of some of the States east of the Mississippi the climate assists to limit them through high summer temperatures and long periods of drought. West of the Mississippi the climate is still less favourable, and as the soil has less of the retentive character in receding from the Mississippi, the favorite cultivable turf almost wholly fails. The prairies are more richly and variedly grassed in British America, and they doubtless merge gradually into humid climates and tenacious soils, both east and west of the plains above the 40th parallel" Bl. p. 451.

"The great prairies have many peculiar species [of grass] of most tenacious hold until the turf is broken, but then almost incapable of reproduction as they rarely produce seeds and never spread from the root.





Longitude West 90 from Greenwich. 85 80 Washington 75 70 65

"There is no part of the United States equal to England in the number and excellence of the grasses native or exotic. On the whole Atlantic plain at this latitude [39° to 40°] the cultivated English grasses are with difficulty maintained.

"In the middle states there are several species of blue grasses (*poa compressa*)—but they do not appear to be adapted to the prompt seeding and ready cultivation which are so necessary to a varied agriculture—next to these on the south there is a large number of subtropical *sorghums* or millet grasses. The sugar cane is itself frequently cultivated as a grass with success." (id. pp. 449-52.)

The prairie grasses make good pastures in their wild state and grow where the timothy, clover and even blue grasses will not, but when the land is brought under culture, the wild grasses cannot be reset in districts even partially deprived of summer rains. In no part of the United States, west of the Mississippi, are the rains in the summer. In the north and N. W. of New Mexico they are mainly in winter; in the southern parts of Texas and New Mexico they are in autumn; and west of Arkansas in spring.

The pastures and meadows, with their accompanying flocks, herds and the dairy, have a value equal, if not superior, to the cereals. From the great and rapidly increasing demand for horses, beef and mutton in the great centres of commerce and manufactures on both continents, the pasture lands of Canada must assume, in the near future, an importance scarcely to be overestimated.

The chief grazing region, the chief meadows and pastures in North America, the home of the flocks, herds and the dairy, must be in the Dominion of Canada, embracing as it does the zones of summer rains, and lying in latitudes and positions similar to the western and central parts of Europe.

Taking as our guide the temperatures and rainfall, the existence of native grasses, and the analogy of Europe, we are justified in the inference that the cultivable grasses in the Dominion would extend over an area of more than two million square miles, or more than 1,200,000,000 acres. Deducting such percentage of untillable lands as is usually found in countries—and Canada is made up chiefly of the vast plains of her great river valleys—there would still remain an almost boundless region the most favourable for pastures and meadows.

es
es

ar
are
he

nd
be
the
in
s in

ual,
ton
ada

cks,
ains,

logy
tend
such
f the
most

LES.

40

45

86

MAP VII.

WHEAT, BARLEY, RYE, OATS, &c.; ROOT CROPS, VEGETABLES.

The Northern limit of wheat is about 58° north latitude; in Norway it ripens as high as latitude 64°, and in Sweden to 62°, but is not much cultivated beyond 60°, and falls off gradually in the east.

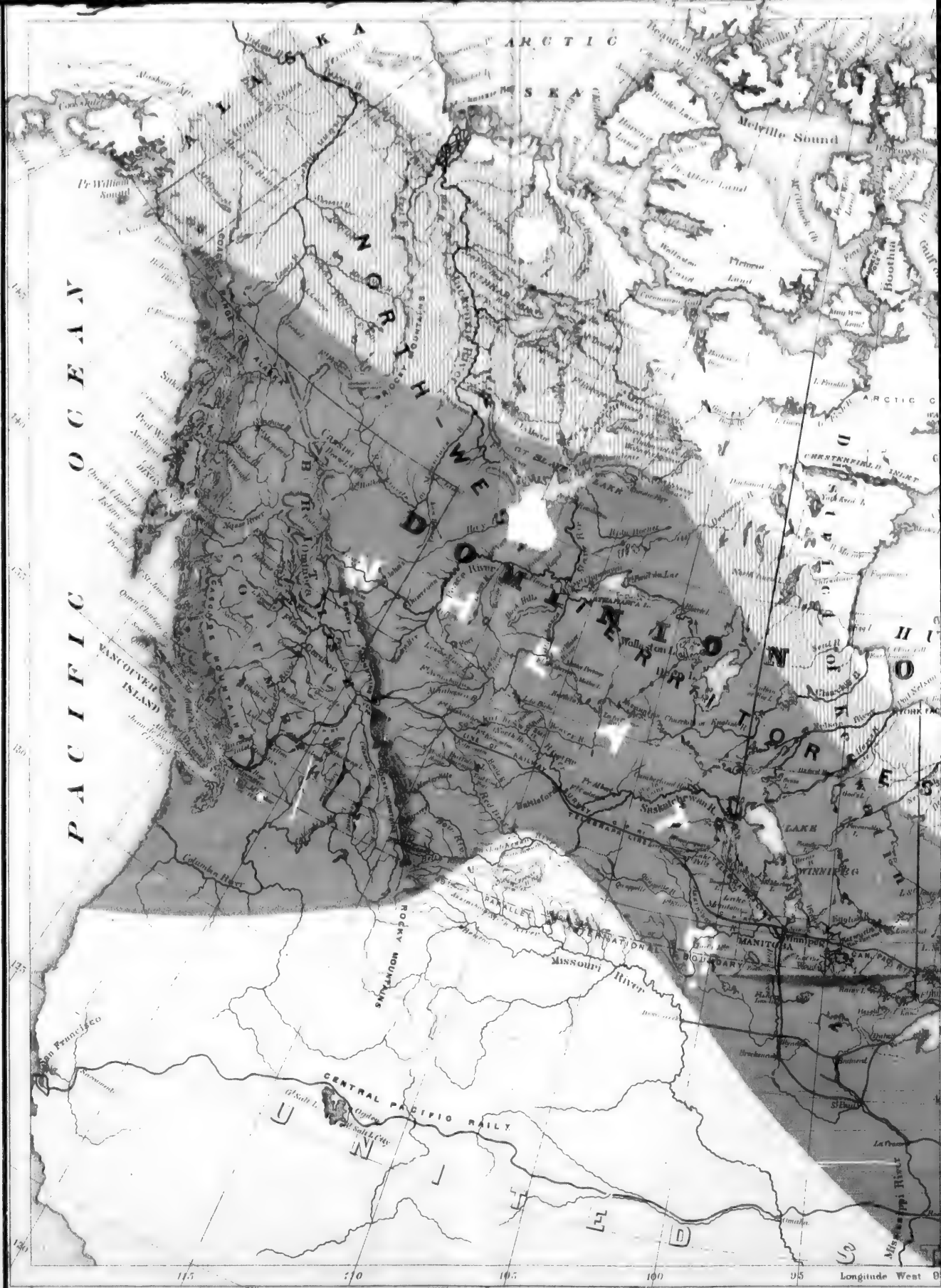
In the interior of the continents it matures north of latitude 60° where the summer temperatures are at 60° Fahrenheit, with one month at 68°. On western coasts, as at Aberdeen in Scotland, it ripens in a summer of 57° with one month at 58°; in England, at a temperature of 60°; at Kasan in Russia (lat. 56°) at 60° 9'. On western coasts, especially in the higher latitudes, in addition to low temperatures, the growth of wheat is restricted by a too humid atmosphere, and by the prevalence of fogs and clouds. The summers in the west of England and Ireland have seven-tenths of the days cloudy. The prevalence of damp, fogs and cloudy weather, limits the profitable growth of wheat chiefly to the central and eastern parts of England, and often affects the whole west of Europe.

In warm climates, the humid tropical heat is destructive to the wheat plant, as along the Atlantic coast of the United States to lat. 37°, and in the interior to lat. 39°, where wheat cannot be grown; below these parallels the temperatures are also too high for wheat, the summers ranging from 78° to 82°. Vast territories even north of the line named have temperatures in the agricultural months quite too high for the profitable culture of this cereal, the coarser grains and grasses. The summers of Illinois, Missouri, Kansas, and the whole country east of the desert areas of the United States, are ten to fifteen degrees higher than the best districts for the grains and grasses. Central Illinois has a summer of 74°; Ohio, 70° to 74°; Iowa, 72° to 78°; Kansas and Missouri, higher still. These temperatures are at least ten degrees too high for the profitable growth of wheat, barley, oats, rye, and the cultivable grasses. Hence the beginning of the summer heat is the end of the further growth of these plants. Add to this the droughts, arid winds off the deserts, and other attendants of such prairies, and we have a climate destructive to the great staples of the temperate zones.

Great Britain, one of the most favoured regions for wheat, has a summer of about 60° to 62°; London has 61·9°; Glasgow 60°; Swansea 62°; Dublin 60°; Liverpool 57° 6'; and the central counties of England 62°.

Canadian summers, necessarily varied over such a vast region, have nearly the same temperatures as the best wheat districts of the old world—from 60° to 70°. Halifax has 60° 8'; Fredericton (New Brunswick) 64° 8'; Quebec, 69°; Montreal, 70° 8'; Toronto, 61° 3'; Manitoba, 67° to 70°; Vancouver, 61° 5'.

The cultivated cereal grains and grasses come to us through the cool, humid, equable climates of the





west of Europe, and thrive best and almost exclusively in similar districts on this continent, which are north of the United States.

The native plants used as food—as Indian corn, rice, &c.—are all tropical or subtropical, and cannot be cultivated in the north of the United States nor in Canada—excepting Indian corn, which adapts itself to the middle latitudes of the temperate zone, but in all cases carries with it its semitropical character of requiring a high temperature—a summer of 65° with one month at 67°.

Sir John Richardson (*Arc. Ex.* vol. 2, p. 207) says that wheat is grown with success in latitude 60° 5', near the borders of Great Slave lake. Bishop Taché found it growing up to 62° on the same lake, and further west it will mature at a higher latitude; it grows freely on the Saskatchewan (lat. 54°) and luxuriantly in the valleys of the Assiniboine and Red rivers, often producing, with imperfect tillage, 40 bushels to the acre, and grown in successive crops for 20 years on the same fields. This region is, says Blodget, the seat of the greatest average yield of wheat on the continent, and probably in the world. (*Can. P.*, p. 33.)

“Two-thirds of the Peace river region [extending to latitude 60°] is fit for wheat” (Prof. Macoun's *ev.* 1876). Even near the southern shores of Hudson Bay at Fort Moose “where the soil is a cold wet clay, with a level undrained surface, wheat accidentally sown was found to ripen.” (Bell's *R. Geo. Survey*, 1877). This is far north of the wheat zone as given in the map.

Hence the immense areas in the North-west in Canada favourable for wheat. South of the Northern limits where wheat has been found maturing, east of the Rocky Mountains and west of Ontario, there are some 950,000 to 1,000,000 square miles in these north-west territories of Canada. This immense area of 600,000,000 acres, lies in a similar position on this continent and with climates almost identical, with the best wheat countries of the old world, the western, northern, north-western and central parts of Europe. It lies, too, in the valleys of the great rivers of the northern half of the continent—the Saskatchewan, Assiniboine, Red, Winnipeg, Peace, Athabaska and Mackenzie, with probably a larger percentage of tillable soil than any equal area in the old world.

Even to this vast area we must add at least another 200,000,000 acres, over 300,000 square miles of wheat land in old Canada—covering the valley of the St. Lawrence—New Brunswick, Nova Scotia, Prince Edwards, British Columbia and Vancouver. Wheat and other grains, it must be remembered, produce more per acre, with surer crops, in the higher latitudes, and near their northern limits.

Deducting from these 800,000,000 acres the usual allowance for mountainous districts and cold soils—(this latter to include all north of the summer isothermal of 68°, which reaches the parallel of 62° in the interior)—there would still remain a practically boundless area of the best wheat land on the continent.

In stating the northern limits of these plants, it is not, of course, assumed that they can be profitably grown at such high latitudes, although they usually produce surer and better crops near their northern limits; the reference is made to show the area adapted to their culture.

BARLEY, RYE, &c.

The statements made in reference to wheat apply to barley, oats, and other small grains, except that these go into colder and more humid climates by nearly five degrees of mean temperature. They bear colder summers, poorer soils and shorter periods of growth. Barley is the most flexible, ripening its grain in the short summers under the Arctic circle on the west of Norway, and going nearly as far on Mackenzie river in North America. Oats bear cool humid climates better than wheat, but are more susceptible to frost. Rye ripens somewhat farther north in cool dry climates than wheat and upon poorer soils.

Barley occupies the most northern limits of grain culture, ripening at 70 degrees north latitude in Lapland, at $67\frac{1}{2}^{\circ}$ to 68° in northern Russia and 68° in the eastern parts. On the north-west coast of Europe it does not go so far north, as the mean temperature of the summer months falls, and the climate, through excessive moisture, is less favourable. It extends from the north of Scotland to the Shetlands, but seldom ripens properly.

In North America barley ripens well at Fort Norman in latitude 65° , 400 miles north of the Orkneys and the capital of Sweden, and 350 miles north of the capitals of Norway and Russia. As barley will mature five degrees farther north than wheat, no doubt when these northern countries in Canada shall have been cleared of the forests and the land drained, barley and other food plants will, in the new world, go as far north as in the old. On the Peace river in latitude $58^{\circ} 9'$, longitude 116° , barley sown on the 8th of May was cut on the 6th of August, 90 days. The grain was large and of beautiful colour. (*Macoun's Geo. Rep.* 1875-6, p. 159.)

The summer of Youkon, west of Mackenzie river, under the Arctic circle is $59^{\circ} 7'$ with a July at $65^{\circ} 7'$. These temperatures are high enough and the summer long enough to ripen barley.

The Northern limit of rye in Norway is 67° , in Sweden 65° to 66° , in Russia 63° to 64° , following the same curve as oats. In Siberia, rye is grown up to the northern limits of corn culture, and in the north-west of Canada it is also found to ripen as far north as barley; but we have not the data to justify us in fixing its northern limits.

As barley and rye ripen four to five degrees farther north than wheat, there are at least half a million of square miles more land adapted to these grains than to wheat in the north-western territories of the Dominion.

In Russia, Germany and parts of France, rye furnishes the bread of at least one-third of the population.

BARLEY, RYE, OATS, &c.

Oats are grown to the extreme north of Scotland in latitude $58^{\circ} 40'$; in Norway to 65° ; in Sweden to $63\frac{1}{2}^{\circ}$; therefore not quite so far north as rye. In Russia the Northern limits seem to coincide with those of rye. Their culture extends southwards to the northern parts of France but not much south of Paris. (latitude $48^{\circ} 50'$). In North America wild oats are found growing to near the northern limits of grain culture. Macoun found oats in latitude 56° four feet high, barley of nearly equal growth, wild grass three feet. (*Geo. R.*, 1875-6, p. 154.)

In Scotland, Lancashire, in Northern Germany, and Westphalia, oaten bread or oaten cake still forms a staple in the food of the poor. Pease and hops do not go so far north as oats, but the climates and soils over vast areas in the North-west of Canada, are favourable for them, and wild vetches and pease are found at a very high latitude. At latitude 56° wild pease and vetches grow to an amazing height. Vetches, roses, willows, herbs and grasses of *genera*, *poa*, *triticum*, and *bromus*, have almost tropical luxuriance." (*Geo. R.*, 1875-6, p. 152. at *Hudson Hope, Peace R.*)

Prof. Bell (*Geo. R.*, 1877.) found at Ft. Moose, near Hudson Bay, "oats, barley, beans, peas, turnips, beets, carrots, cabbages, onions, tomatoes and potatoes growing without any more care than is required in other parts of Canada," although "the soil is a cold, wet clay with a level undrained surface."

Flax is a splendid crop in *Mea. toba*. It is a summer crop in Northern climates, but a winter crop in climates like Egypt, following the same laws as wheat, which is a summer crop in the higher temperate zones, and a winter crop in Egypt, Australia, California and countries of similar climates, where it grows during the winter months, ripening its grain before the heat and drought of summer. For such plants the summer heat of these lower latitudes is too great, but the winter months are suited to their growth and the spring to their maturity.

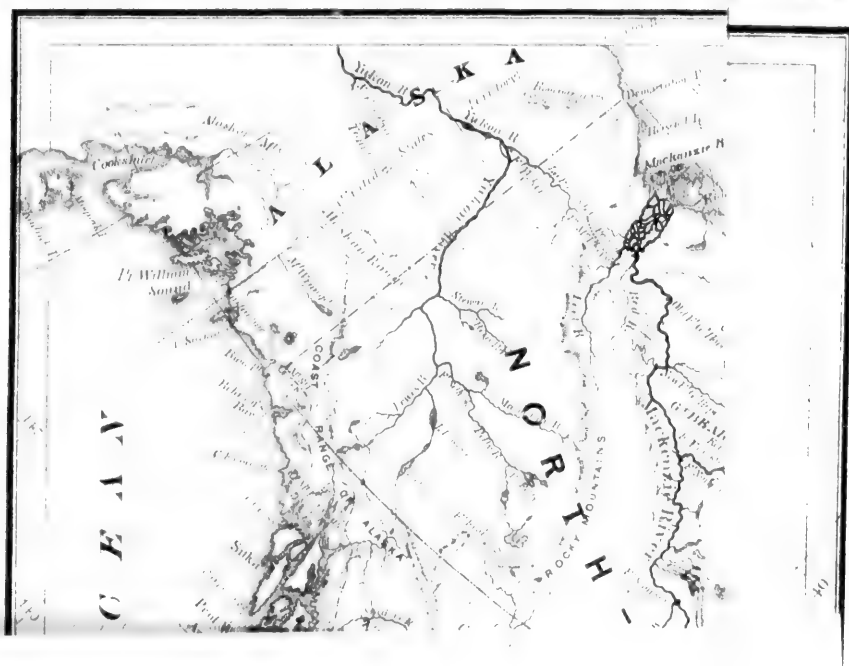
Hops grow well in climates suited for wheat and the coarser grains. Wild hops grow luxuriantly in the valley of the Kaministiquia west of lake Superior latitude 49° , also in the valleys of the Red and Qu'appelle rivers. Professor Macoun found wild hops on the Qu'appelle west of Fort Ellice in latitude 51° and longitude 100° to 105° . Wherever found the growth was very rank, and in the autumn covered with its fruits. The reports make no reference to their growth in the north-western territories beyond the limits named, but from the positions in which they are most cultivated in Europe there can be no doubt that there are large areas in the north-west of Canada with climates well-suited to their culture. Hops of the finest quality are extensively grown in all the other provinces of the Dominion.

ROOT CROPS, &c.

The polar limits of the potato are beyond those of barley in Scandinavia, and advance into Iceland, where barley cannot be grown; but in Iceland the potato is said to be little larger than a walnut. In putting the northern limits of the potato and turnip a degree or so higher than barley we still keep within their climatic range. Turnips will go to even a higher latitude than the potato, but the other vegetables here named will not grow so far north. As these vegetables can be used when but partly grown, they may be cultivated in high latitudes, and in short summers, where they will not ripen, and farther north than even the coarser grains. Hence the immense areas in Canada over which these food plants may be grown.

Sir A. Mackenzie says "that in 1788 a small spot was cleared [lat $58^{\circ} 45'$ long, 117] at the Old Establishment [Fort Vermillion?] and sowed with turnips, potatoes, carrots and parsnips. The first grew large and the others thrived well," (P.R.R. 1879, P. 31.) On the Peace river near the Rocky Mountains at latitude $56^{\circ} 30'$ potatoes, onions, carrots, cabbages and other vegetables grow in the gardens, and at this date (22nd July) "potatoes planted 28th April were of very fair size and fit for use, growth extremely rapid—thermometer 80° at noon; was informed that in 1874 there was no frost from 1st May until 15th September, [107 days]. In 1875 sowing commenced in the last week of April." (Geo. R. 1865-6, P. 152, by Macoun.)





MAP VIII.

MAIZE AND GRAPES.

Maize (Indian corn), is the most widely diffused grain of the new world, and is grown from the southern extremity of Chili on the 40th parallel in South America up to very high latitudes in the interior of North America, even to latitude $56^{\circ} 12'$, where the high summer temperature allows it to advance farther north than in Europe. In its native climates it requires seven months to mature, but in the north-west, in the centre of the continent, it ripens in 60 days. Sir John Franklin found it in latitude 54° , west of lake Winnipeg. Blodget (p. 532) says "it may be grown on both branches of the Saskatchewan" which lie mostly between the 50th and 54th degrees of north latitude. It requires a summer of 65° Fahrenheit with one month at 67° . This is also the most favourable temperature for the grape.

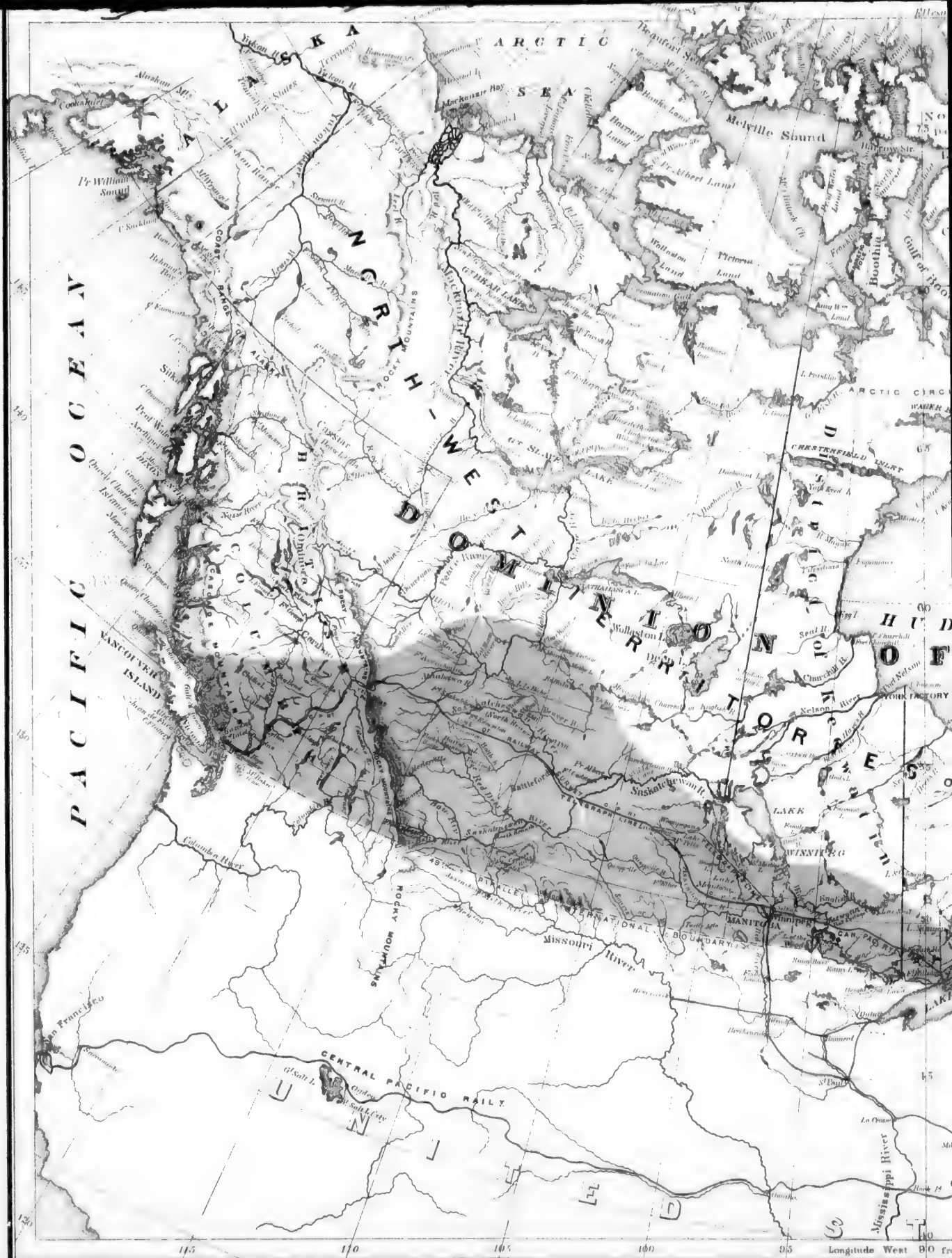
Manitoba and the country west are on the northern limits of the maize zone and are, no doubt, inferior to the valley of the St. Lawrence for this cereal, but its culture has advanced northward from its native climates the most rapidly of all the food plants, adapting itself to the short summers of high latitudes where it ripens in 60 days instead of requiring seven months as in the tropics. It may, therefore, in time, be grown with profit in the interior of the continent south of the summer isothermal of 65° .

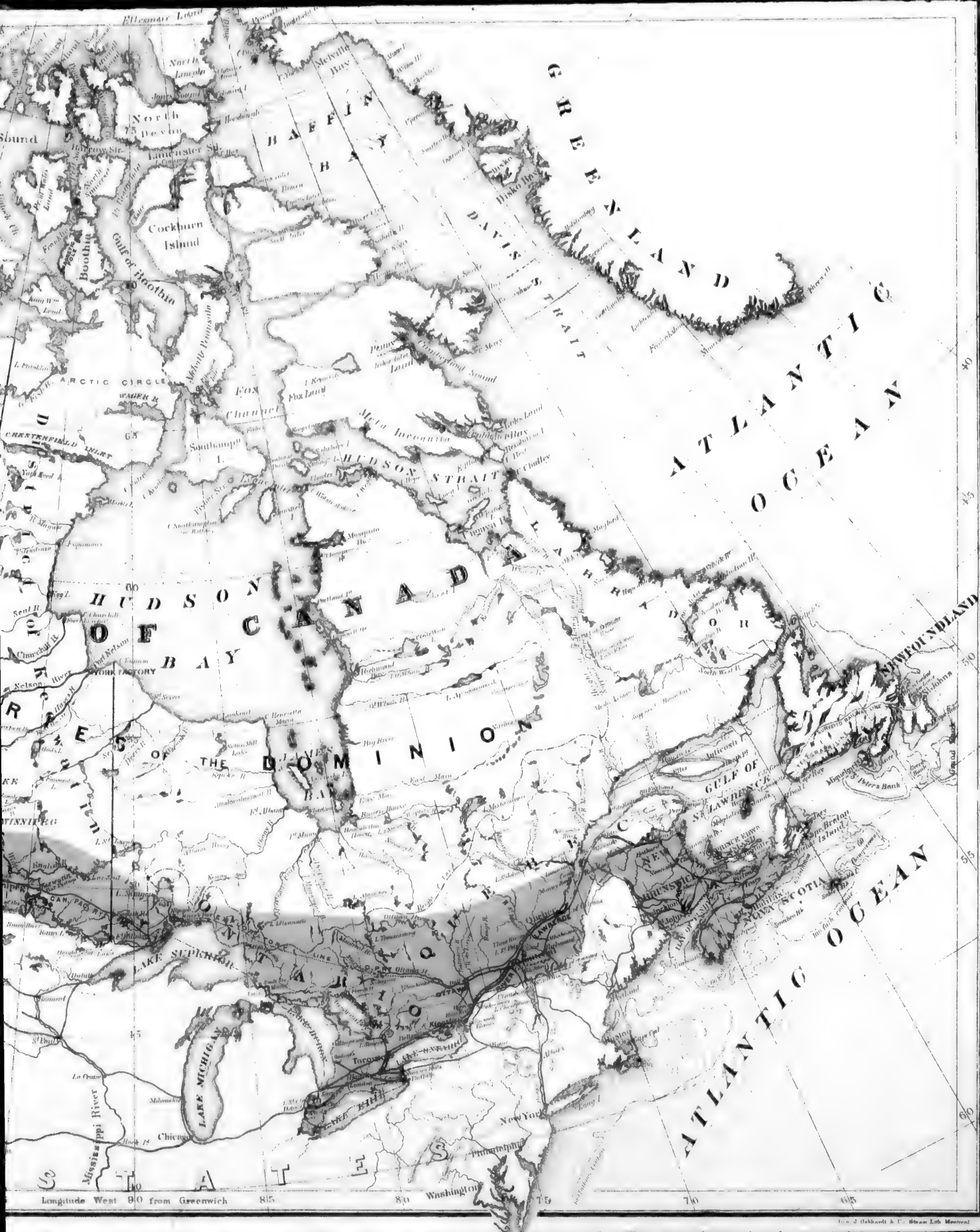
On the Peace river, latitude $56^{\circ} 12'$ and 1,600 feet above the sea, Indian corn had ripened three years in succession. (Prof. Macoun's evidence before committee of House of Commons, March, 1876.)

THE GRAPE is here put with maize because the climatological limits northward are nearly the same -- one map answering for both. The grape will usually ripen its fruit where Indian corn matures. Keith Johnson puts the northern limit of the grape-growing districts in Europe two degrees farther north than that of maize, in latitude 51° in Austria and 52° in Germany, south-east of Denmark. These positions are under the most favourable circumstances.

In the north-western Territories of the Dominion, Dr. Richardson found the wild vine in latitude 52° , and Prof. Macoun found it on the Assiniboine north of Fort Ellice, west of the 100th meridian and as high as the 51st parallel, where it produces excellent fruit.

Its northern limit in the new world has not been ascertained, and in giving it the same as maize we are keeping within its known climatic range. The wild vine is usually found in Canada co-extensive with the maple; and where a native plant has fastened itself without the care of man, we may infer that the climates are favourable for it. In the best wine-producing localities in Europe the grape is found to produce more fruit and better wine under a summer temperature of 67° than where the heat is greater. It is a fact of importance in this connection that both the vine and Indian corn produce better





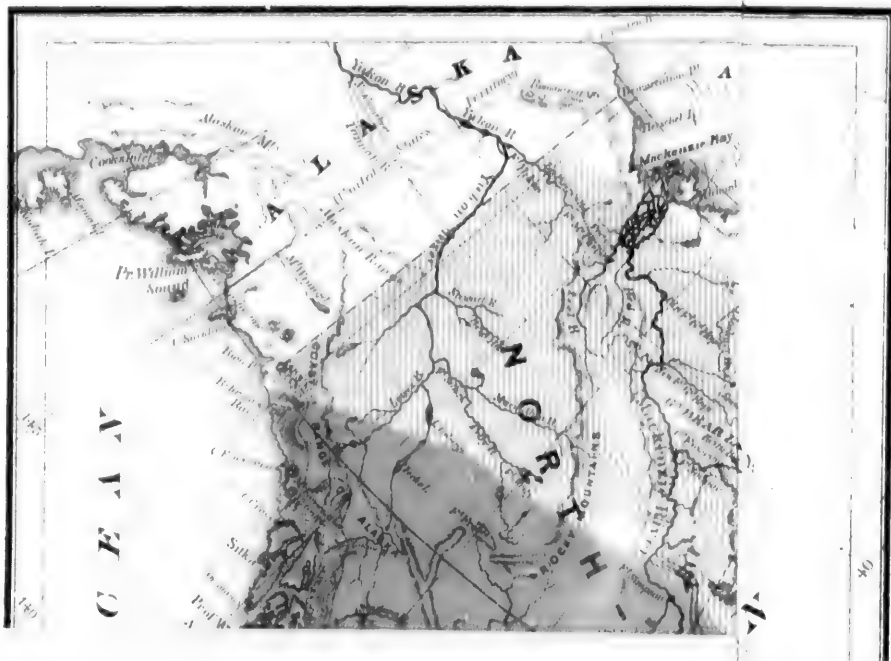
fruit and in greater abundance north of their native climates. In the States of New York and Massachusetts, instances are given of Indian corn yielding from 100 to 170 bushels to the acre, three-fold more than it produces in its native climate, or even in Illinois and other western and south-western States, regarded as the best parts of the Union for this cereal. In the valley of the St. Lawrence, too, in the Canadas, Indian corn yields more per acre than in Illinois or the south-western States.

The European varieties of the grape seem not to be well adapted to the Canadian climate, but grape-growers in Canada are getting hardy varieties by hybridizing and using the native vine as the standard.

4-
e
s,
e

-
1.

№ 3.



MAP IX.

ORCHARD FRUITS.

The apple, like the cereals, has its proper home north of the summer isothermal of 70° in the cooler parts of the temperate zone, the areas of summer rains. In warmer climates the fruit is inferior in quality, although of good size. The southern and south-eastern parts of the United States are too warm for the apple; and the regions of summer droughts through all the central parts of the continent west of the Mississippi—the treeless region—have climates destructive to the apple-tree; for a climate where deciduous trees will not grow, could not be favourable for the apple-tree.

A writer, in the *New York Graphic* of October 11th, 1876, referring to the Canadian show of fruit at the Centennial Exhibition, Philadelphia, in 1876, says :

"The finest show of fruits is made by the Fruit Growers' Association of Ontario, Canada." A distinguished American pomologist, from Illinois, writing of the fruits at the Centennial in 1876, says : "Decidedly the best show, taking into consideration variety, quality, number and taste, is from Ontario, Canada.

"The exhibit occupied two tables, each 200 feet long, with 1480 plates of apples, 200 of pears, 290 of plums, 173 of grapes, 26 of peaches, 86 of crab-apples, and 20 of miscellaneous fruits, nuts, &c."

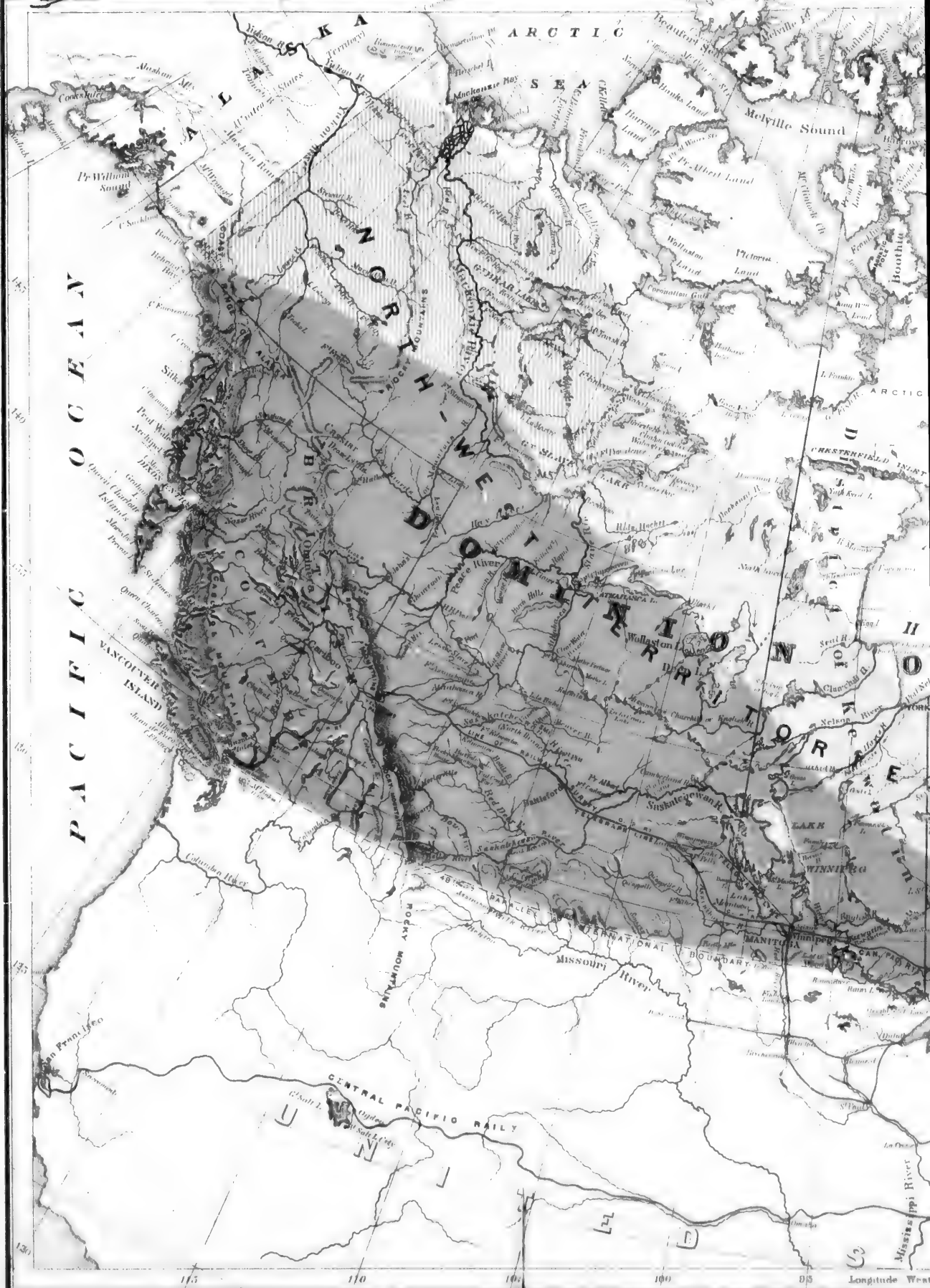
Marshall, in his work on Canada, after visiting an agricultural show which represented only the country around London, in Ontario, says: "upwards of a hundred varieties of apples were exhibited. For cooking there were the Cayuga, Red Streak, or twenty ounce peppin, an imposing fruit measuring over fifteen inches. The Alexander of glorious crimson, the Red Astracan or Snow-apple, so named from the whiteness of its pulp; the Gravenstein, Baldwin and others. For dessert there were the Fameuse, the streaked St. Lawrence, the Spitzenberg, the Seek-no-farther of gold and red." p. 76.

"The Canadian apple is the standard of excellence, p. 7.

"Even in California, the orchard of the Union, the superiority of the Canadian apple was, to my surprise, confessed. Vast quantities are exported to England and sold as American, their nationality being lost.

"The grape thrives well, raspberries, strawberries, blackberries or brambles, cranberries, cherries and other fruits, currants, plums, grapes, apples, &c., grow wild, orchards everywhere thrive." p. 77.

In 1863 the Royal Commissioners of the International Exhibition of London, asked from the representatives of all the countries at the exhibition, a collection of fruit from their respective countries to be





shown in the gardens of the Royal Horticultural Society of London. It became the duty of the writer, as a commissioner from Canada, to make the collection from this country. He wrote to the Fruit Growers' Association of Upper Canada for a collection, but it being too early in the season for that society to send the fruit, the local Horticultural Society of Hamilton, a town at the head of Lake Ontario, 1260 miles from the Atlantic, sent a collection. The officers of the Royal Horticultural Society reported that this show of apples was the finest they had ever had from any one country, and the chief countries of Europe and the United States had collections at the Royal Horticultural Gardens in that year.

In Europe the apple ripens in latitude 64° and thrives well up to 60°. The area in Canada over which it could be cultivated would equal that of wheat. The pear will not mature so far north, but thrives well wherever tried throughout the valley of the St. Lawrence; and in British Columbia north of 50° attains to a great size—eleven inches in circumference. It is also grown in Manitoba. Wild plums and cherries are everywhere found throughout the valley of the St. Lawrence and up to high latitudes as far as the deciduous forest trees extend; the black cherry especially growing to a large tree, two and three feet in diameter and sixty to seventy in height in the southern part of Ontario. The red cherry is a smaller but more hardy tree. The wild yellow egg-plum was found in Upper Canada on its first settlement of a size which would be considered large amongst cultivated plums at the present time, the trees being more than a foot in diameter. Where the native plum and cherry were found growing spontaneously, we may assume that the climate and soil are favourable for such fruits, and experiment has proved the correctness of this inference. The analogy of Europe would justify us in placing the northern limits of these two fruits as high as the parallel of 60°.

Canada is on the northern limit of the peach growing zone, yet in favourable seasons immense crops have been produced over large areas in the southern and south-western parts of Canada. The fruit too is of excellent quality, large and delicious. The writer has had peaches at the head of lake Ontario eleven inches in circumference and the fruit quite superior to any imported. The peach, however, will not bear transit like the apple.

SMALLER FRUITS.

These smaller fruits are usually found coincident with the grasses, and the currants and gooseberries with the forests, failing only in the North from climatic defects where the grasses and forests fail. Sir John Richardson found the wild currant growing with the grasses and shrubs, and the showy epilobium on the shores of the Arctic Ocean in latitude 69° . Strawberries have been found by explorers on the most northern limits of the grass-producing regions, even around the cold humid shores of Hudson Bay and as high as 57° on the eastern coasts of that vast inland sea. Small fruits, cucumbers, musk-melons and vegetables of all kinds come to maturity at Norway House, near latitude 54° (Geo. R., 1879, p. 31, cc.) But the isothermal of July and August which would pass through Norway House would go north of 60° on Mackenzie river and to the Arctic Circle at Youkon.

A high temperature even in a short summer is sufficient to ripen these smaller fruits, and the temperature beyond the Arctic Circle at Fort Youkon is given in the Russian records at $65^{\circ} 7'$ for July, 60° for August and $59^{\circ} 7'$ for the summer—June, July and August. Fort Simpson on Mackenzie river, in latitude $61^{\circ} 51'$, has a June of $63^{\circ} 6'$ and a July of $61^{\circ} 51'$. Fort Chipewyan on lake Athabaska, latitude $58^{\circ} 48'$, has a July 63° . Even York Factory, in latitude 57° , on Hudson Bay, the temperature of which is lowered by the cold waters of that vast inland sea, has a July of 60° .

In Norway and Sweden the berry fruits go to latitude 63° and even in Kamtchatka on the eastern coast, where it is at least ten degrees colder than on the western or interior regions, the blackberry is found in latitude 53° to 54° .

The northern boundary of these smaller fruits may be placed as high as the grasses, and over the vast regions of the interior co-extensive with the pastures and meadows.

"Strawberries, raspberries, currants, cranberries, and two kinds of cherries are abundant on Peace river [to latitude 58°]. The flora of the whole of Peace river is much the same as central Ontario. Cucumbers started in the open air were fully ripe" [August 15th, latitude $58^{\circ} 24'$.] (*Prof. Macoun's evidence.*)







TERTIARY

MAP X.

NOTES ON THE GEOLOGICAL MAP.

This map, supplied by Alfred R. C. Selwyn, F.R.S., Director of the Geological Survey of Canada, is intended to show as nearly as is possible on so small a scale the location of the principal economic minerals in Canada. Farther and closer exploration will doubtless very largely increase the number of these localities; but the map serves to indicate in the meantime that Canada is generally rich in valuable minerals, and that mining industries may probably be established successfully in almost every part of the Dominion. The abundant indications of workable coal-seams throughout the great north-western grain growing region is, on account of the scarcity of timber over large areas, an especially fortunate circumstance, and one which must materially promote its successful settlement. There are also in all probability, in the region between lakes Winnipeg and Athabaska, vast stores of salt and petroleum awaiting the enterprise and energy of future settlers for their development.

